Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Broadcast Incentive Auction Comment Public Notice Auction 1000, 1001 and 1002	)	AU Docket No. 14-252
	)	
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	GN Docket No. 12-268
	)	

COMMENTS OF LOCUSPOINT NETWORKS, LLC

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February 20, 2015

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EXECUTIVE SUMMARY

The Commission deserves high praise for the hard work, dedication, and creative thinking that has brought it to the cusp of conducting the first-of-its-kind two-sided spectrum incentive auction. The upcoming auction presents broadcasters, the wireless industry, and the U.S. Treasury will unique opportunities to derive enormous benefits. Most significantly, the reallocation of unimpaired UHF band spectrum for mobile broadband services will spur innovation, create jobs, and serve as a catalyst for new business creation and increased economic growth. The Commission is very close solving the "Rubik's Cube" problem that was presented by this auction. Doubts have faded about whether this new, novel and complex auction is feasible, and now the question is "how successful can this auction be?"

LocusPoint Networks, LLC ("LPN") appreciates the extraordinary work done thus far by the Chairman and Commissioners, as well as by all members of the Incentive Auction Task Force. The task, however, is not yet done. In these comments, LPN recommends modifications to some of the proposals made on December 17, 2014 regarding procedures for the incentive auction, and urges the Commission to reaffirm its commitment to accepting applications for the incentive auction in late 2015, with the auction beginning in early 2016. Specifically, to enhance the incentive auction's prospects for success, LPN encourages that the Commission:

- Give more weight to the interference component of its proposed methodology for determining reverse auction opening prices than to the population component;
- Abandon, or at least reduce the reliance on, the proposed "dynamic reverse price" mechanism;
- Aim high when setting the initial spectrum clearing target, focusing on clearing as much unimpaired spectrum as possible in areas where is will be valued most highly in the forward auction; and
- Adopt other auction procedures (such as smaller bid decrements in the reverse auction and providing broadcasters the ability to direct clearing payments to multiple accounts) that will encourage broadcaster participation and promote the Commission's goal to clear the maximum amount of spectrum for mobile broadband use.

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Through the upcoming broadcast incentive auction, the Commission is poised to unleash enormous economic benefits for the American economy by reassigning a large amount of prime low-band spectrum from broadcast to mobile broadband use. LocusPoint Networks, LLC ("LPN")[1] applauds the Commission for the hard work it has done in establishing an elegant framework for the incentive auction and in educating television broadcasters on the unique financial opportunity presented by the reverse auction. With sufficient participation by broadcasters who are willing to relinquish some or all of their spectrum usage rights, the Commission could clear as much as 126 MHz of spectrum. This outcome is within reach, but it is not guaranteed, and the Commission's resolution of the issues teed up in the above-captioned Public Notice[2] can either make it more likely or jeopardize it.

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[1] LPN is the controlling interest holder in 11 UHF television stations, including stations in the New York, Chicago, Philadelphia, San Francisco, Miami, Detroit, Baltimore, Orlando, Buffalo, and Milwaukee Designated Market Areas. LPN is a founding member of the Expanding Opportunities for Broadcasters Coalition ("EOBC") and an associate member of the Association of Public Television Stations, and is actively pursuing discussions with commercial and non-commercial television licensees to encourage their participation in the incentive auction, including through channel sharing arrangements.

[2] *Comment Sought on Competitive Bidding Procedures for Broadcast Incentive Auction 1000, Including Auctions 1001 and 1002*, AU Docket No. 14-252 & GN Docket No. 12-268, *Public Notice*, 29 FCC Rcd 15750 (rel. Dec. 17, 2014) ("*Comment PN*").

In order to fully capitalize on the potential of the broadcast incentive auction, the Commission must avoid the temptation to micro-manage the incentive auction and instead should adopt market-based auction policies and procedures that will serve the central goal of this entire exercise: to maximize to amount of unimpaired spectrum made available through the auction. Below, LPN offers recommendations on the issues it believes are most important to producing maximum broadcaster participation, the prerequisite for a successful incentive auction.

I. The Commission Should Commit To Its Current Schedule for the Broadcast Incentive Auction, Which Will Spur Broadcaster Participation and Foster Significant and Lasting Benefits for the American Economy

It has been nearly five years since the Commission laid out its vision to make 500 MHz of spectrum newly available for broadband use within the next 10 years, with 300 megahertz between 225 MHz and 3.7 GHz made newly available for mobile use within five years.[3] Of this 300 MHz, the National Broadband Plan targeted 120 MHz for reallocation from broadcast to mobile broadband services, noting that this reallocation presents the opportunity "to create new economic growth and investment opportunities."[4] Though the timetable for reassigning broadcast spectrum to more valuable mobile broadband use has (for understandable reasons) not met the *National Broadband Plan*'s aspirations, the goal of reallocating at least 120 MHz is within reach. As the Commission reiterated in the *Comment PN*, it intends to "begin accepting applications to participate in the broadcast incentive auction in the fall of 2015, and to start the bidding process in early 2016."[5]

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[3] *Connecting America: The National Broadband Plan*, Federal Communications Commission (rel. Mar. 17, 2010), at 84 (Recommendation 5.8), available at http://www.fcc.gov/national-broadband-plan.

[4] *Id*. at 88 (Recommendation 5.8.5).

[5] *Comment PN* at ¶ 8.

Repurposing as much UHF television spectrum as possible so that it can be reorganized into paired mobile broadband licenses will generate huge benefits for the American economy. And the sooner this can be accomplished, the better. According to a new report prepared by The Brattle Group (attached hereto as Attachment 1):

> Mobile broadband, and the spectrum that enables it, creates jobs, motivates capital investment, spurs innovation in existing industries and is the catalyst for entirely new industries. Beyond these economic benefits, mobile broadband spectrum creates consumer welfare that is **at least 10 and more like 20 times greater than the economic value of the spectrum**. Furthermore, the spectrum reallocated during the Incentive Auction is expected to save capital investment and reduce the cost of wireless broadband, as well as motivate more competition in the wireless industry.[6]

A successful broadcast incentive auction will clear the way for increased innovation and investment in the mobile broadband market, which will have a multiplier effect on U.S. economic growth. Any further delay in the incentive auction should be avoided, as it "will defer deployments into the future, resulting in lost revenue and consumer welfare [that] quickly add[s] up and **could easily approach $200 billion**."[7]

At the conclusion of the AWS-3 auction, the Chairman and Commissioners, as well as leaders on Capitol Hill and Wall Street, recognized that the auction results showed that demand for spectrum continues to be strong, and predicted high demand for the 600 MHz band spectrum to be offered in the incentive auction. There is every reason to believe these predictions. Recent reports confirm that the mobile licenses for spectrum reallocated in the incentive auction are highly desirable and will generate enormous forward auction revenues. A recent white paper by Kagan Media Appraisals concludes that, even on the current timetable, there are "irresistible

[6] The Brattle Group, *On Track: Benefits from the Incentive Auction* (Feb. 20, 2015) ("*Brattle Group Report*"), at 5 (emphasis added).

[7] *Id*. (emphasis added).

drivers for the carriers to be there and bid hard for the spectrum that suits their needs."[8] And a report authored by auction economist Peter Cramton and his research team projects that at least $84.9 billion can be raised for 10 paired blocks of 600 MHz Band spectrum.[9] Clearly, the Commission need not fear that proceeding on the current schedule will suppress demand for licenses in the forward auction.

In addition, doubts regarding whether the incentive auction will occur on schedule puts at risk the credibility of the incentive auction process itself – especially among the broadcasters the Commission wants to attract to the auction. A further delay will generate additional uncertainty about the auction process, slow down progress toward channel sharing deals, and generally impede the Commission's effort to generate sufficient broadcaster participation to satisfy its spectrum clearing goals. In its discussions with other broadcasters, LPN is constantly asked whether the current timetable is real, and many broadcasters are reluctant to fully engage in planning for the auction until the schedule is truly fixed. A clear commitment from the Commission to stick to the current schedule will maintain the forward momentum the Commission has worked so hard to create.

With a tremendous amount of dedication and creative thinking, the Commission is on the cusp of an historic auction that will meet the twin goals of the 2012 Spectrum Act – putting the 600 MHz Band to its highest and most efficient use, and generating significant revenues for the U.S. treasury. The Commission should make it clear that the incentive auction will take place as currently scheduled.

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[8] Kagan Media Appraisals, *Can the FCC Attract a Full House for the 2016 Broadcast Incentive Auction?* (Feb. 11, 2015) ("*Kagan White Paper*"), attached as Exhibit A to the comments filed Feb. 19, 2015 by EOBC in this proceeding (the "EOBC Comments"), at 36.

[9] *See* Peter Cramton, Hector Lopez, David Malec, and Pacharasut Sujarittanonta, *Design of the Reverse Auction in the FCC Incentive Auction*, attached as Exhibit B to the EOBC Comments, at 20.

II. The Commission Should Give Greater Emphasis To the Interference Component of Its Proposed Methodology For Determining Reverse Auction Opening Prices

When it adopted the framework for the incentive auction, the Commission determined the policy that should guide the setting of opening prices in the reverse auction. It stated that prices should be determined according to factors "that affect the availability of channels in the repacking process and, therefore, the value of a station's bid to voluntarily relinquish spectrum usage rights."[10] Thus, the Commission confirmed, "a station with a high potential for interference will be offered a price that is higher than a station with less potential for interference to other stations."[11] The Commission also stated: "We emphasize that we do not intend to set prices to reflect the potential market or enterprise value of stations, as opposed to their impact on the repacking process."[12]

The Commission's proposed formula for determining opening price offers,[13] however, runs counter to the policies set forth in the *Incentive Auction R&O*. The formula for "Station Volume" – calculated as $(\text{Interference})^{0.5} * (\text{Population})^{0.5}$ – appropriately includes the number of interference constraints that a station's continued operation would place on the repacking process, but it inappropriately assigns equal weight to the population that station covers, which is irrelevant to the station impact on the repacking process. It is common for stations with lower population coverage figures to have a greater preclusive effect on the repacking process than other stations with far higher population figures.[14] Adopting the proposed formula, which gives

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[10] *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, *Report and Order*, 29 FCC Rcd 6567, 6753 ¶ 450 (rel. Jun. 2, 2014) ("*Incentive Auction R&O*").

[11] *Id.* at ¶ 450.

[12] *Id*. at ¶ 451.

[13] *See Comment PN* at ¶ 96.

[14] *See* EOBC Comments at Exhibit D (listing 1,100 stations that directly block service to a population at least two-and-a-half times greater than their interference-free population).

equal weight to the population factor, will lead to a less efficient auction in which the Commission to pay higher prices to stations with lesser repacking impacts.[15]

The Commission offers several justifications for the population component of the formula,[16] but none can withstand scrutiny. There is no direct relationship between a station's interference-free population and either the value of the corresponding mobile licenses that will be awarded in the forward auction or the Commission's ability to close the reverse auction more quickly.[17] In addition, the Commission's is incorrect in claiming that it is legally obligated to include the population component so that it can meet its statutory obligation under Section 309(j) of the Communications Act to promote the interests of taxpayers. Section 309(j) imposes no obligations on the Commission with respect to the reverse auction; it directs the Commission to adopt *forward* auction methodologies that serve the objective of recovering value for taxpayers. Furthermore, the significant weight given to the population component actually could negatively affect forward auction revenues by suppressing broadcaster participation and reducing the number of mobile broadband licenses that ultimately are offered in the forward auction.

The Commission's proposed "balanced approach" to calculating station volume, which gives equal weight to interference constraints in the repacking and to population, is therefore misguided on both legal and policy grounds. It unnecessarily raises the risk that the Commission will be unable to reallocate an efficient amount of spectrum for mobile broadband use. LPN therefore urges the Commission at least to reduce the weight given to population relative to

[15] While there are arguments for increasing the base clock price of 900 to a higher level, doing so should not be considered to be a solution to the problems identified with the population component of the station volume formula.

[16] *See Comment PN* at ¶ 98.

[17] In any event, the recent AWS-3 auction, which the Chairman and all of the Commissioners have hailed as a great success, went on for a protracted 341 rounds, so speeding up the reverse auction does not support the proposed population component, which will jeopardize the reverse auction's efficiency and the overall goals of the incentive auction.

interference constraints in its proposed station volume formula.[18]

III. The Commission Should Eliminate, Or At Least Reduce, The Uncertainties Inherent in the Use of A Dynamic Reserve Price Mechanism

The Commission's proposed "Dynamic Reserve Price" mechanism ("DRP") would increase the risk that the entire incentive auction will fail. By enabling the Commission to continue to reduce clearing offers made to stations even after it is determined that they can no longer be repacked, DRP introduces unnecessary complexity and uncertainty into the reverse auction and suppress broadcaster participation. To enter the reverse auction with confidence, stations need to be assured that market-based forces, and not Commission fiat, will determine the prices they ultimately are paid. If adopted, the Commission's DRP proposal would destroy that confidence.

The DRP mechanism that the Commission has proposed is complex and unpredictable, and the Commission has not explained exactly how it would be implemented. These conditions suggest that the Commission would like to use DRP to artificially drive down clearing prices. This sends exactly the wrong message to broadcasters who may be on the fence about participating in the incentive auction. Furthermore, if implemented as proposed, the reverse auction would begin with DRP "turned on," which will necessarily create more impaired spectrum for the forward auction than would otherwise be the case. This will drive down the value of the mobile broadband spectrum, exactly the opposite of what the public interest demands.

The Commission has not demonstrated that DRP is necessary. In fact, the opposite is true, because (1) the market-based design of the incentive auction assures against paying stations

[18] In its comments on the *Comment PN*, EOBC has offered a "compromise proposal," under which the structure of the station volume formula would be preserved, but the exponent for the population component would be modified from 0.5 to 0.25. *See* EOBC Comments at 23-26. LPN supports this proposal.

more than market value for their spectrum usage rights, and (2) the "scoring" of opening bids according to each station's "volume" ensures against unfair relative valuations. It is understandable that the Commission seeks to avoid paying a station an amount unrelated to the price it is truly willing to accept. This perhaps suggests that some form of reserve price may be appropriate if a station cannot be repacked in the reverse auction's opening round, but the proposed DRP mechanism, which would continue for an indeterminable number of rounds, is not needed. The uncertainties inherent in the use of DRP will discourage broadcaster participation in the reverse auction, and therefore the Commission should abandon, or at least limit, the use of DRP.[19]

IV. When Setting the Initial Clearing Target for the Reverse Auction, The Commission Should Aim High, Avoid Impairments As Much As Possible, and Keep It Simple

The Commission should set its sights high when it determines its initial spectrum clearing target for the reverse auction. The maximum economic benefit from the incentive auction will be achieved only if the Commission focuses on the goal of clearing a much unimpaired spectrum as possible for mobile broadband use. Given recent evidence of increasing broadcaster interest in the incentive auction,[20] the Commission has every reason to believe that it may be able to clear at least 120 MHz of UHF spectrum. The Commission therefore should strive to set the initial clearing target at the highest possible level with as much unimpaired spectrum as possible. The

[19] The Expanding Opportunities for Broadcasters Coalition has proposed the "Round Zero Reserve" ("RZR") concept as an alternative to DRP. *See* Notice of Ex Parte Presentation, Letter from EOBC Executive Director Preston Padden to FCC Secretary Marlene H. Dortch (Feb. 3, 2015), at 3-4. LPN support adoption of this proposal as an alternative to DRP.

[20] *See, e.g.*, Notice of Ex Parte Communication, Letter from Mace Rosenstein, Counsel for Fox Television Stations, Inc., ION Media Networks, Inc., Tribune Media Company and Univision Communications Inc. to FCC Secretary Marlene H. Dortch, GN Docket No. 12-268 (Feb. 6, 2015); *see also* Fierce Wireless, *CBS open to selling spectrum in 600 MHz incentive auction, might fetch $2B* (Feb. 13, 2015), available at http://www.fiercewireless.com/story/cbs-open-selling-spectrum-600-mhz-incentive-auction-might-fetch-2b/2015-02-13.

Commission should be mindful, however, that not all impairments are equal. For example, impairments of any kind in the New York region are dangerous due to the ripple effect they would have throughout the Northeast corridor. In contrast, because of the distances between major markets in California, that region could tolerate more interference without a harmful ripple effect. The Commission should therefore make it a priority to avoid impairments in the New York region.[21]

The proposed optimization procedure that will be conducted in setting an initial spectrum clearing target requires modification if it is truly to optimize the amount of spectrum ultimately reallocated. The *Comment PN* states that the "primary objective" of the initial optimization procedure is "to minimize the total impaired weighted-pops nationwide …."[22] However, the optimization procedure provides no safeguards to avoid impairment of spectrum in the most valuable markets, and the Commission's proposals to allow up to 20 percent of the nationwide weighted-pops to be impaired and to implement DRP (which by its very nature pushes impairment toward the 20 percent limit) run counter to this stated objective. The proposed optimization procedure raises the risk that more spectrum than necessary will become impaired in the areas where demand for spectrum will be the highest.

Furthermore, the proposed optimization procedure is highly complex, with results that cannot be predicted. The incentive auction should be made as simple as possible, and the clearing target optimization procedure is no exception. The Commission allowed for "some market variation" in order to make more spectrum available in the forward auction,[23] meaning that optimization should be designed to achieve the simple goal of maximizing the amount of

[21] The Commission must also take account of the complexities of our international border relationships and take care to balance impairments so as not unfairly impair any particular border area.

[22] *Comment PN* at ¶ 43.

[23] *Incentive Auction R&O* at ¶ 82.

unimpaired spectrum repurposed in the areas where mobile broadband spectrum will be most in demand. Only then will the Commission help the wireless industry satisfy the exploding demand for mobile broadband services and applications.

To achieve the goals of the incentive auction, the Commission also should reduce the proposed cap on impairments (20 percent of weighted-pops nationwide) and the proposed ceiling for permissible impairment in a forward auction license (50 percent impairment.[24] Each of these proposed thresholds threaten to destroy spectrum value and raise the risk that the Final Stage Rule will not be met in a given auction stage. Under a 20 percent impairment cap, it is possible that a major market (e.g., New York, Los Angeles, Chicago) could have significant impairment, depressing the value of the entire 600 MHz band to wireless carriers. This 20 percent impairment threshold should be adjusted lower so that it does not severely impair the value of the repurposed mobile broadband spectrum.

Offering licenses that are as much as 50 percent impaired also poses risks to the auction. If forward auction bidders regard the proposed bidding credit for impaired licenses (one percent of discount for each percent of impairment) as insufficient to account for the lower value of significantly impaired licenses, they will discount their bids accordingly. They also are likely to bid aggressively in the forward auction's assignment phase to avoid being assigned significantly impaired licenses, but the revenues associated with that value would not count toward satisfaction of the Final Stage Rule. Thus, at any clearing target, offering blocks that are as much as 50 percent impaired threatens the success of the auction and presents only downside risk to the Commission's spectrum reallocation goals. The Commission should therefore reduce this threshold.

[24] *Id*. at ¶¶ 25, 146.

V. The Commission Should Adopt Other Auction Procedures That Will Encourage Broadcaster Participation and Promote Clearing the Maximum Amount of Spectrum

1. Reduce the Size of Bid Decrements

The *Comment PN* proposes that the Commission have the discretion to reduce clearing offers round-to-round by between three percent and 10 percent and to change the size of price decrements at "any point during the reverse auction based on bidding activity during the auction."[25] These proposals are inappropriate for this first-of-its-kind auction, in which broadcasters will require a sufficient opportunity to process information during the auction and assess whether to accept the next clearing offer.

Even the low end of the range of per round decrements suggested by the Commission (three percent) will force broadcasters – many of whom are not experienced in participating in FCC auctions – into deciding whether to accept large price reductions, especially in the early rounds. Faced with declining price offers of even three percent per round will lead some broadcasters to decide to exit the auction prematurely, thereby increasing the chances that the auction will fail. The Commission spectrum clearing goals will be far better served by adopting a more gradual price decrement structure.

The Commission's proposal to allow itself the discretion to change the size of the price decrements round by round serves only to multiply the challenge faced by participating broadcasters. Rather than raising the level of anxiety broadcasters may feel about participating in the incentive auction, the Commission should be trying to ease these fears. LPN therefore recommends that the Commission adopt a price decrement no higher than one percent per round. This is not likely to lengthen the auction to any significant degree, but even if it did, it would be

[25] *Comment PN* at ¶ 105.

worth it to foster increased broadcaster participation.

2. Allow Sufficient Time Between The Reverse and Forward Auctions

If the Commission decides to adopt the proposed impairment thresholds, LPN suggests that it afford forward auction bidder more time between the reverse and forward auctions to evaluate the impairments, which will not be fixed until the reverse auction ends. The Commission has proposed to commence the forward auction on the second business day after the close of reverse auction bidding.[26] While this period may suffice if impairments are few, forward auction bidders may need additional time to evaluate the situation under the level of potential impairment proposed by the Commission. Expanding this interstitial period by a few additional days is reasonable so as to provide addition assurance that bidding in the forward auction is as aggressive as it can be.

3. Adopt the Proposed Hierarchy of Bid Relinquishment Options, As Well As The Proposal to Forbid Moves to Greater Relinquishment

The *Comment PN* proposes a hierarchy of bid relinquishment options. For a UHF station participating in the reverse auction, they are (from greatest to least): Go Off-Air; Move to Low-VHF; and Move to High-VHF.[27] The Commission also proposes that reverse auction bidders "will not be permitted to bid for options that would involve greater relinquishments than the most recent option selected."[28] LPN believes that these proposals make good sense as they will facilitate the orderly conduct of the reverse auction.

4. Increase the Size of the Discount in Opening Offers for VHF Bid Options

In the *Comment PN*, the Commission tentatively concluded that opening bid prices for a station choosing to move from the UHF or High-VHF bands to the Low-VHF band would be set

[26] *See id.* at ¶ 66.

[27] *Id.* at ¶¶ 72-73.

[28] *Id*. at ¶ 74.

at between 67 and 80 percent of that station's Go Off-Air price, and that for stations choosing to move from the UHF band to the High-VHF band, the opening bid price would be between 33 and 50 percent of the station's Go Off-Air price.

LPN is concerned that, because these discounts are not higher, they may discourage UHF broadcasters from making plans to enter into channel sharing arrangements, which provide greater control and certainty as to whether to clear UHF spectrum. The Commission therefore should discount opening prices for the VHF bid options by an even greater amount. Specifically, the opening price for a station choosing to move from UHF or High-VHF to Low-VHF should be at most 50 percent of the station's Go Off-Air price, and the opening price for a station choosing to move from UHF to High-VHF should be at most 25 percent of the station's Go Off-Air price. Adoption of these deeper discounts will better promote the spectrum clearing goal of the incentive auction.

5. Allow Reverse Auction Payments To Be Directed By Participating Licensees

In the *Incentive Auction R&O*, the Commission determined that it would "disburse payments to the licensee that is the reverse auction applicant when sharing proceeds from the auction."[29] In channel sharing and other contexts, however, licensees likely will make arrangements obligating them to share the proceeds that would result from successful relinquishment of spectrum usage rights. Such arrangements are entirely appropriate and should be encouraged by the Commission, as they will increase the participation of broadcasters in the reverse auction. These relationships would be substantially simplified, and an element of counterparty risk removed, if the Commission were to allow the participating licensees to specify in their pre-auction applications the accounts into which their clearing payments are to be

[29] *Incentive Auction R&O* at ¶ 538.

deposited, with the permissible accounts not limited to those owned by the licensee. This relatively easy to implement tweak to auction procedures will promote the Commission's goal of maximizing broadcaster participation.

VI. Conclusion

The Commission – and especially the Incentive Auction Task Force – deserves high praise for the hard work, dedication, and creative thinking that has brought it to the cusp of conducting this historic auction. The question seems no longer to be whether the Commission can conduct this new, novel and complex auction, but instead how successful can it be. LPN appreciates the unique opportunity that the incentive auction presents for it and other broadcasters. The Commission has moved the ball into the "red zone," but it should not have to settle for a field goal. With the modifications suggested herein, the Commission can get the ball over the goal line and produce a win-win-win scenario, with enormous benefits accruing to the broadcast industry, the American taxpayers, consumers of mobile broadband services, and the American economy as a whole. Respectfully, LPN hopes that the Commission will seize the opportunity and modify the proposals made in the Comment PN along the lines described herein.

Respectfully submitted,

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February 20, 2015

ATTACHMENT 1

Staying On Track:

Realizing the Benefits from the FCC's Incentive Auction without Delay

PREPARED FOR

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February 20, 2015

THE Brattle GROUP

This report was prepared for LocusPoint Networks, LLC. All results and any errors are the responsibility of the authors and do not represent the opinion of The Brattle Group, Inc. or its clients.

Acknowledgement: We acknowledge the valuable contributions of many individuals to this report and to the underlying analysis, including members of The Brattle Group for peer review.

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Summary

In its upcoming Incentive Auction, the Federal Communications Commission is undertaking the most important and innovative spectrum auction in decades. This auction is critical to meeting the growing demand for mobile broadband and the economic and consumer benefits associated with mobile broadband. Calls for further delays in this auction risk unnecessarily postponing and diminishing these benefits. Enormous societal benefits are at risk. Additional spectrum, especially the lower band spectrum that will be repurposed in the Incentive Auction, is critical to enabling new and stronger national wireless providers, and thereby encouraging more competition. Beyond competition, the welfare enhancing benefits to society are as much as 20 times the nominal value of the spectrum that we estimate to be more than $60 billion.

Further delaying the Incentive Auction unnecessarily puts off and forgoes these benefits. Each year of delay reduces the economic value of the spectrum and costs society $60 billion in forgone consumer welfare. The pending presidential election implies that any delay is likely to last for 2 to 3 years, easily creating total costs approaching $200 billion. Such costs are totally unnecessary. Many potential bidders with access to sufficient capital are likely to participate if the auction stays on track for early 2016. A well designed auction with multiple well financed bidders will realize the value of spectrum that the wireless industry is expecting—and can afford—from the Incentive Auction.

Simply put, there is nothing to be gained from delay—only costs in the form of foregone benefits.

I. Delay the Incentive Auction?

The Federal Communication Commission's (FCC's) Incentive Auction is currently scheduled to begin in early 2016 and to start accepting applications in the fall of 2015.[1] Originally scheduled to begin in mid-2015,[2] the FCC already delayed the Incentive Auction after the National Association of Broadcasters (NAB) filed a lawsuit in August 2014.[3] Although the FCC currently states that it is still on track to begin in 2016,[4] there are advocates pushing the Commission to postpone the Incentive Auction beyond 2016. These advocates' stated concerns include: "i) its proximity to the AWS-3 auction; ii) some noise around the rules (specifically Dynamic Reserve Pricing); and iii) a concern over whether or not the computer systems are ready for this level of complexity."[5] Further delay, however, would unnecessarily forgo significant benefits from repurposing TV spectrum.

As a result at least in part of the NAB lawsuit the Incentive Auction has already been delayed by at least one year. Publicly, NAB pushes for "prompt resolution of the pending petition."[6] At the same time, the organization is urging the FCC to simplify the reverse auction procedures to make

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1 Gary Epstein, "Incentive Auction Progress Report," Federal Communications Commission, October 24, 2014, available at http://www.fcc.gov/print/node/73342.

2 FCC, "Estimated Timeline of Key Events Leading up to FCC's Broadcast Incentive Auction," June 25, 2014, available at http://wireless.fcc.gov/incentiveauctions/learn-program/Incentive_Auction_Timeline.pdf.

3 The NAB'S lawsuit is over concerns that the FCC's current repacking process does not fully protect repacked stations from potentially losing some of their current coverage area. Gautham Nagesh, "TV Broadcasters Sue Over FCC Auction of Airwaves," The Wall Street Journal, August 18, 2014, available at http://www.wsj.com/articles/tv-broadcasters-sue-over-fcc-auction-of-airwaves-1408402394.

4 John Eggerton, "Wheeler: Incentive Auction is on Course and Speed," Broadcasting and Cable, January 29, 2015, available at http://www.broadcastingcable.com/news/washington/wheeler-incentive-auction-course-and-speed/137544. Analysts at Wells Fargo claim that Chairman Wheeler is the only individual not to have called for a delay in the Incentive Auction. See, Marci Ryvicker, John Huh and Stephen Bisson, "Broadcast/Outdoor: Gearing Up for Q4 Earnings," Wells Fargo Securities, LLC, January 26, 2015, page 8, available from Thomson One, accessed February 17, 2015.

5 Going one step further, analysts at Wells Fargo claim that some broadcast groups think the Incentive Auction won't even happen at all. See Marci Ryvicker, John Huh and Stephen Bisson, "Broadcast/Outdoor: Gearing Up for Q4 Earnings," Wells Fargo Securities, LLC, January 26, 2015, page 8, available from Thomson One, accessed February 17, 2015.

6 Phone call between Gordon H. Smith, President and CEO of NAB, and Chairman Tom Wheeler on February 5, 2015. See Rick Kaplan, "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," GN Docket No. 12-268, *Notice of Ex Parte Communicatio*n (February 6, 2015).

it as "simple and transparent as possible."[7] They claim to be concerned with several elements of the Incentive Auction, including dynamic reserve pricing and channel sharing rules.[8] These sentiments have been supported by various broadcaster representatives who claim that the success of the recent AWS-3 auction was due, in part, to its simplicity.[9] Given NAB's current lawsuit, there is little evidence that they are fully committed to a 2016 Incentive Auction. Rather, it seems highly plausible that the organization might use requests to simplify and clarify the reverse auction rules as a justification for further delay.[10]

The AWS-3 auction saw over $41 billion in net winning bids[11] with AT&T bidding over $18 billion, Verizon over $10 billion and DISH affiliated entities bidding over $9 billion.[12] Controversy regarding the price discounts that DISH's affiliated entities received could have spill

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7 Rick Kaplan, "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," "Office of Engineering and Technology Releases and Seeks Comment on Updated OET-69 Software," and "Office of Engineering and Technology Seeks to Supplement the Incentive Auction Proceeding Record Regarding Potential Interference Between Broadcast Television and Wireless Services," GN Docket No. 12-268, ET Docket No. 13-26, and ET Docket No, 14-14, *Reply Comments of the National Association of Broadcasters* (February 5, 2015).

8 Rick Kaplan, "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," GN Docket No. 12-268, *Notice of Ex Parte Communication* (February 9, 2015).

9 Mace Rosenstein, Counsel for Fox Television Stations, Inc., ION Media Networks, Inc., Tribune Media Company and Univision Communications Inc., "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions" and "Broadcast Incentive Auction Comment Public Notice Auction 1000, 1001 and 1002," GN Docket No. 12-268 and AU Docket No. 14-252, *Notice of Ex Parte Communications* (February 6, 2015).

10 This push for simplicity and transparency of the reverse auction has been echoed by members at the FCC. See Michael O'Rielly, Remarks at The American Enterprise Institute Luncheon, Washington, DC, January 21, 2015; Matthew Berry, "Tech Policy 2015: The Year Ahead," Remarks at The American Enterprise Institute, January 28, 2015; and Ajit Pai, "Communicators with Ajit Pai," C-SPAN Interview, January 21, 2015.

11 "Auction of Advanced Wireless Services (AWS-3) Licenses Closes, Winning Bidders Announced for Auction 97," *Public Notice*, DA 15-131 (rel. January 30, 2015).

12 DISH participated in the auction using three entities: American AWS-3 Wireless ($0 in bids), Northstar Wireless ($5.8 billion in bids) and SNR Wireless ($4.1 billion). Even though Northstar Wireless and SNR Wireless made provisional winning bids upwards of $13 billion the two entities are only required to pay $9.9 billion because they qualified for a 25% discount from the FCC. See Phil Goldstein, "DISH's Road to $3.33B in AWS-3 Discounts Included a Complex Web of Investments," Fierce Wireless, February 4, 2015, available at http://www.fiercewireless.com/story/dishs-road-333b-aws-3-discounts-wove-through-complex-web-investments/2015-02-04; "Auction of Advanced Wireless Services (AWS-3) Licenses Closes, Winning Bidders Announced for Auction 97," *Public Notice*, DA 15-131 (rel. January 30, 2015), Attachment B.

overs and cause further delay of the Incentive Auction.[13] In addition, many advocates of delay raise concerns that, after spending large amounts in the AWS-3 auction, these wireless players may not have capital available for an Incentive Auction in 2016.[14] Parties agree that the participation of wireless carriers in the Incentive Auction is critical to its success.[15]

Some argue that a delay in the Incentive Auction is likely to advantage some players, such as AT&T and Verizon, and disadvantage other players, such as Sprint and T-Mobile. John Legere, CEO of T-Mobile, has publicly told the FCC that delaying the Incentive Auction past 2016 would only benefit Verizon and AT&T[16] and in a December 2014 blog post wrote, "AT&T and Verizon will continue to try and monopolize the industry as well as try to stall the incentive auction, preventing competitive carriers like T-Mobile from winning sufficient amounts of low-band spectrum."[17]

Some point out that a delay in the Incentive Auction give AT&T and Verizon time to raise additional capital for bidding in the Incentive Auction.[18] A delay would also delay T-Mobile's and Sprint's opportunity to purchase low-band spectrum. This would leave AT&T and Verizon with a longer period of time over which the two carriers will dominate the low-band spectrum

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13 Most notably, analysts have argued that the DISH dispute could lead to Incentive Auction delays because the FCC will likely be interested in adjusting auction rules to avoid an outcome similar to DISH's in the AWS-3 auction. Holman W. Jenkins Jr., "The Wireless Kingpin of Deadwood," *The Wall Street Journal*, February 13, 2015, available at http://www.wsj.com/articles/holman-jenkins-the-wireless-kingpin-of-deadwood-1423871312; Kevin Manning, "Spectrum Auction: Overrun by Shells and Shills," BMO Capital Markets Corp., February 1, 2015, page 1, available from Thomson One, accessed February 17, 2015.

14 John Eggerton, "Wheeler: Incentive Auction is on Course and Speed," Broadcasting and Cable, January 29, 2015, available at http://www.broadcastingcable.com/news/washington/wheeler-incentive-auction-course-and-speed/137544.

15 Michael O'Rielly, Remarks at The American Enterprise Institute Luncheon, Washington, DC, January 21, 2015; Matthew Berry, "Tech Policy 2015: The Year Ahead," Remarks at The American Enterprise Institute, January 28, 2015; Ajit Pai, "Communicators with Ajit Pai," C-SPAN Interview, January 21, 2015.

16 Kathleen O'Brien Ham, "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions" and "Policies Regarding Mobile Spectrum Holdings," GN Docket No. 12-268 and WT Docket No. 12-269, *Ex Parte Notification* (January 23, 2015).

17 John Legere, "What's Next in Wireless: My 2015 Predictions," T-Mobile Issues and Insights Blog, December 30, 2014, available at http://newsroom.t-mobile.com/issues-insights-blog/2015-predictions.htm.

18 Michael O'Rielly, Remarks at The American Enterprise Institute Luncheon, Washington, DC, January 21, 2015; Matthew Berry, "Tech Policy 2015: The Year Ahead," Remarks at The American Enterprise Institute, January 28, 2015; and Ajit Pai, "Communicators with Ajit Pai," C-SPAN Interview, January 21, 2015.

coverage.[19] AT&T and Verizon already own over 70% of highly sought-after low band spectrum.[20] Moreover, AT&T and Verizon will have access to large amounts of new AWS-3 spectrum. The two companies spent the largest amount in the AWS-3.[21] Sprint did not participate in the AWS-3 auction. Since Sprint currently does not own any AWS spectrum, it chose to save its cash for the Incentive Auction and avoid integrating a fourth band of spectrum (AWS) into its network.[22] T-Mobile participated in the AWS-3 auction but purchased only a limited supply of spectrum relative to AT&T and Verizon, spending just $1.8 billion.[23]

To date, neither AT&T nor Verizon have publically pushed for a delay in the Incentive Auction. However, Verizon has described a network strategy that uses existing spectrum holdings through 2019.[24] Although some suggest that this is an argument for delay,[25] even if the spectrum is auctioned in 2016, it will not be available to carriers until some point in 2019, at the earliest.[26]

Despite these arguments, delaying the Incentive Auction would delay the benefits that come from repurposing a portion of the TV band. Wireless broadband services create great value for society. The FCC and others have forecasted the need for significant additional spectrum to meet rapidly growing demands for these wireless services. A delay in the Incentive Auction would

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19 Kagan Media Appraisals, *Can the FCC Attract a Full House for the 2016 Broadcast Incentive Auction?* (Feb. 11, 2015), page 14 (Herein "*Kagan White Paper*"), attached as Exhibit A to the comments filed Feb. 19, 2015 by EOBC (Herein the "EOBC Comments"). See "Broadcast Incentive Auction Comment Public Notice Auction 1000, 1001 and 1002" and "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," AU Docket No. 14-252 and GN Docket No. 12-268, *Comments of Expanding Opportunities for Broadcasters Coalition* (rel. February 19, 2015), Exhibit A.

20 "Policies Regarding Mobile Spectrum Holdings" and "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," WT Docket No. 12-269 and Docket No. 12-268, *Report and Order*, FCC 14-63 (rel. June 2, 2014).

21 "Auction of Advanced Wireless Services (AWS-3) Licenses Closes, Winning Bidders Announced for Auction 97," *Public Notice*, DA 15-131 (rel. January 30, 2015), Attachment B.

22 Dan Meyer, "AT&T, Verizon, DISH Rule FCC Spectrum Auction," RCR Wireless News, January 30, 2015, available at http://www.rcrwireless.com/20150130/carriers/att-verizon-dish-rule-fcc-spectrum-auction-tag2.

23 *Ibid.*

24 John Eggerton, "Analyst: Verizon Well-Positioned for Incentive Auction," Broadcasting and Cable, February 18, 2015, available at http://www.broadcastingcable.com/news/washington/analyst-verizon-well-positioned-incentive-auction/138059.

25 John Eggerton, "Analyst: Verizon Well-Positioned for Incentive Auction," Broadcasting and Cable, February 18, 2015, available at http://www.broadcastingcable.com/news/washington/analyst-verizon-well-positioned-incentive-auction/138059.

26 As discussed in Section II.C, the repurposed broadcaster spectrum will not be available for at least 3 years after the conclusion of the auction. This suggests that if the auction concludes in mid 2016, the earliest the spectrum would be available is mid 2019.

delay and forgo the realization of the benefits derived from these services. We estimate the annual cost of delay at more than $60 billion, with the cumulative impact of further delaying the Incentive Auction easily approaching $200 billion.

Moreover, it is unlikely there would be any benefits of further delay. Arguments for further delay rest on the view that an auction in early 2016 would not be successful. This view, however, is incorrect. There are many likely and potential bidders with access to significant capital to spend on spectrum licenses. Furthermore, the wireless industry fully anticipates both the explosive growth in wireless demand and significant additional spectrum purchases. Finally, delaying the auction will not improve the rulemaking process.

Simply put, there is nothing to be gained from delay—only costs in the form of foregone benefits.

II. Costs of Delay

Before assessing the costs of delay, it is helpful to understand the economic and social benefits associated with spectrum deployed for wireless broadband. The economic value of spectrum is based on the profits generated by the services it enables. Thus, the price of spectrum repurposed in the Incentive Auction will be equal to the present value of the profits generated from the mobile broadband services it enables.[27] We estimate below that spectrum sold in the forward auction for TV broadcast spectrum will sell for roughly $2.00/MHz-pop.

Yet, the social and economic benefits of spectrum to the U.S. economy, consumers, and carriers go well beyond this. Mobile broadband, and the spectrum that enables it, creates jobs, motivates capital investment, spurs innovation in existing industries and is the catalyst for entirely new industries. Beyond these direct economic benefits, mobile broadband spectrum creates consumer welfare that is at least 10 and more like 20 times greater than the direct economic value of the spectrum.[28] Furthermore, the spectrum reallocated during the Incentive Auction is expected to save capital investment and reduce the cost of wireless broadband, as well as motivate more competition in the wireless industry.

Delays in the Incentive Auction will defer deployments into the future, resulting in lost revenue and consumer welfare over the course of this delay. If there is any delay, it is likely to stretch out for 2 or 3 years as it is likely a new FCC Chairman after the 2016 elections will want to reevaluate the choices the previous FCC made. As discussed below, these losses quickly add up and could easily approach $200 billion.[29]

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[27] For a detailed explanation, see Coleman Bazelon and Giulia McHenry, "Spectrum Value," *Telecommunications Policy* (2013).

[28] See Section II.B.

[29] See Table 2.

A. General Benefits of More Spectrum

The social and economic benefits of mobile broadband—and the spectrum that makes it possible—are well understood and widely documented.[30] Mobile broadband is, and will continue to be, an essential catalyst for the U.S. economy, spurring economic growth and innovation in existing industries while motivating entirely new industries. And, as the FCC has stated, "[s]pectrum is the nourishment for mobile broadband."[31]

Spectrum has no inherent value; rather, its value is based on the value generated by the services it enables. Since spectrum is an essential input into mobile services, its value is equal to the value it generates for these services. From an economic perspective, this implies that the value of a spectrum license is equal to the stream of future economic profits that the spectrum enables the license holder to receive. This economic profit is what the license holder is willing to pay for the right to use the spectrum. Consequently, assuming a competitive market for spectrum such as exists during an auction, the economic value attributable to a band of spectrum should be equal to the market price paid for the spectrum.

Beyond this direct economic value, mobile broadband and the spectrum that enables it, is credited with benefitting the U.S. economy by creating jobs, motivating capital investment, increasing GDP, and spurring productivity and innovation. For instance, Sosa and Van Audenrode (2011) estimate that reallocating 300 MHz of additional mobile broadband spectrum would lead to $75 billion in capital investment, 300,000 new jobs, and $230 billion in GDP.[32] Roger Entner found that in 2011 alone the U.S. wireless industry created, directly and indirectly, 3.8 million jobs and that 10 MHz of additional spectrum would create 7,053 new jobs.[33] Moreover, Sosa and Van Audenrode suggest that additional wireless broadband capacity would spur even greater effects through innovation spillovers.[34]

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30 For instance, see FCC, "Mobile Broadband: The Benefits of Additional Spectrum," FCC Staff Technical Paper, October 2010; FCC, "Connecting America: The National Broadband Plan," Chapter 5, 2010; FCC Technical Paper No. 3, page 1; Roger Entner, "The Wireless Industry: The Essential Engine of US Economic Growth," White Paper, May 2012; David W. Sosa and Marc Van Audenrode, "Private Sector Investment and Employment Impacts of Reassigning Spectrum to Mobile Broadband in the United States," White Paper, August 2011 (herein "Sosa and Van Audenrode (2011)"); CTIA, "Broadband," available at http://www.ctia.org/policy-initiatives/policy-topics/broadband; Thomas W. Hazlett, Roberto E. Muñoz, and Diego B. Avanzini, "What Really Matters in Spectrum Allocation Design," Northwestern Journal of Technology and Intellectual Property (2012), Vol. 10 (3): page 95.

31 FCC, "Spectrum Analysis: Options for broadcast spectrum," OBI Technical Working Paper No. 3, June 2010, page 1. (Herein, "OBI Technical Working Paper No. 3".)

32 Sosa and Van Audenrode (2011), pages 1-2. They further estimate even greater effects from reallocating a full 500 MHz of spectrum to wireless broadband over a longer period.

33 Roger Entner, "The Wireless Industry: The Essential Engine of US Economic Growth," White Paper, May 2012, Exhibit 13.

34 Sosa and Van Audenrode (2011), page 6.

The proliferation of wireless broadband enabled by spectrum has also driven entirely new industries, such as mobile smartphones and devices, mobile apps, and wearable devices.[35] The economic and social impact of these new industries is substantial. For instance, Michael Mandel estimates that, as of 2012, the App Economy, which emerged after the iPhone was released in 2007, was responsible for 466,000 jobs. The same study estimated that this new sector generated nearly $20 billion in revenue 2011.[36] Other new emerging sectors have substantial social benefits, in addition to the economic benefits. For instance, the White House's 2012 report on "The Economic Benefits of More Spectrum for Wireless Broadband" highlighted the economic and social importance of both mobile health care and mobile education sectors.[37]

Moreover, the demand for wireless services, and the spectrum it requires, is only increasing. Cisco estimates that by 2019 U.S. mobile data traffic will reach 3.6 exabytes per month, which is a 7-fold increase from 2014.[38] This increase in traffic will be driven by an increasing number of users, more mobile connections per user, and growing demand for faster speeds and more intensive data uses, such as mobile video. For instance, by 2019, mobile users are expected to increase by 21 million to 290 million; mobile connections will increase by over 600 million to over 1 billion; and mobile video traffic will represent 75% of total traffic.[39]

Aware of these demands, the FCC identified repurposing the TV Broadcast spectrum for mobile broadband as critical to efficiently meeting the growing demand for wireless services. When building mobile broadband networks, there is a tradeoff between the essential inputs: spectrum and network equipment.[40] Consequently, more spectrum enables more efficient capital investments, and lower cost wireless broadband services. In 2010, in conjunction with the release of the National Broadband Plan, the FCC estimated that an additional 300 MHz of spectrum would save $120 billion in capital spending to meet the wireless broadband demands.[41]

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35 For example, Cisco estimates that connected wearable devices will increase to 578 million by 2019, up from 109 million in 2014. Robert Pepper, "Cisco Visual Networking Index (VNI) Forecast), Mobile Data Traffic Update, 2014 – 2019, Focus on U.S." Cisco Presentation, February 3, 2015, Slide 12. (Herein, "Cisco VNI Forecast Presentation")

36 Michael Mendel, "Where the Jobs Are: The App Economy," White Paper, February 7, 2012, pages 1 and 4.

37 Executive Office of the President Council of Economic Advisors, "The Economic Benefits of More Spectrum for Wireless Broadband" February 2012, available at http://www.whitehouse.gov/sites/default/files/cea_spectrum_report_2-21-2012.pdf.

38 Cisco VNI Forecast Presentation, slide 5.

39 Cisco VNI Forecast Presentation, slide 6.

40 For instance, the FCC constructed an indifference curve between the amount of spectrum and capital required to meet the forecasted demand. See FCC, "Mobile Broadband: The Benefits of Additional Spectrum," FCC Staff Technical Paper, Exhibit 22.

41 This was the basis of the FCC's call for 300 MHz of spectrum to be reallocated for mobile broadband within the next five years. See National Broadband Plan, Chapter 5; and FCC, "Mobile Broadband:

Continued on next page

Moreover, the FCC identified the repurposed TV Broadcast spectrum as an essential component of meeting this goal.[42]

In addition to creating new economic value through wireless services, the reallocation and assignment of new spectrum for wireless broadband may increase competition for wireless services. The TV Broadcast band reverse auction is an opportunity to make valuable spectrum below 1 GHz[43] available to smaller existing carriers and potential new entrants.[44] Access to this low band spectrum may enable new entrants or smaller carriers to compete more effectively, thereby potentially increasing competition for mobile broadband and lowering prices for consumers. Even more, since low band spectrum has its greatest advantages for rural deployments, making this spectrum available may help to improve competitive access with mobile broadband in rural areas.

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The Benefits of Additional Spectrum," FCC Staff Technical Paper, October 2010, page 2 and Exhibit 22.

42 National Broadband Plan, Chapter 5; and OBI Technical Working Paper No. 3.

43 Many argue that low-band spectrum has better in-building penetration and that lower frequencies propagate further than high-band spectrum and, thus, is better-suited for wireless build out in rural areas. Wireless carriers have also stated that the build-out costs for low-band spectrum are lower than the build-out costs for high-band spectrum. "Policies Regarding Mobile Spectrum Holdings" and "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," WT Docket No. 12-269 and Docket No. 12-268, *Report and Order*, FCC 14-63 (rel. June 2, 2014), paragraphs 31-33. In general, these arguments are strongest for new buildouts of networks. Higher frequencies can be advantageous for adding capacity. For example, multiple-input multiple-output (MIMO) technology allows for better system efficiency, increased peak data rates and increased system capacity. Massive MIMOs, which require dozens of antennas at the base station, are much more efficient at high frequencies because they require that antenna elements be spaced based on wavelength. Higher frequencies have shorter wavelengths, allowing for greater exploitation of MIMO. See "MIMO: An Overview", High Frequency Designs, December 2011, available at http://www.highfrequencyelectronics.com/Dec11/1112_HFE_mimoOver.pdf; Peter Rysavy, "Learn How Technology Will Turn Less Desirable Airwaves into 'Beachfront' Spectrum," Gigaom, June 28, 2013, available at https://gigaom.com/2013/06/28/learn-how-technology-will-turn-less-desirable-airwaves-into-beachfront-spectrum/.

44 In its June Report and Order the FCC proposed a system of small business credits, identical to the system used in the 700 MHz auction, to promote the purchase of spectrum in the Forward Auction by small carriers and new entrants. A small business is defined as an entity with three-year average gross revenues less than $40 million and a very small business has three-year average gross revenues less than $15 million. The FCC then gives small businesses a bidding credit of 15% and very small businesses a bidding credit of 25%. "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," GN Docket No. 12-268, Report and Order, FCC 14-50 (rel. June 2, 2014), at paragraphs 472-483.

The importance of low band spectrum can be seen through international comparisons. In most European countries, the mix of spectrum and, consequently, the networks deployed are less differentiated than in the U.S.[45] This has led some analysts to argue for the importance of additional low band spectrum for Sprint and T-Mobile to provide them with a better coverage network so that they can compete directly with AT&T and Verizon.[46] Also, should a new entrant seek to provide national wireless broadband coverage, a network that includes lower frequencies would be a distinct advantage, whether a newly built proprietary network or an MVNO (mobile virtual network operator) supplemented with unlicensed access. In any case, a strong coverage network allows off-loading onto unlicensed frequencies to be more viable.[47]

B. Wireless Creates Great Consumer Benefits

In addition to creating economic value, as explained below, mobile broadband and spectrum create enormous consumer benefits. The wireless industry generates about $200 billion in revenues, contributing directly to our nation's wealth.[48] The value of the repurposed TV spectrum to wireless firms and the economy is only a fraction of the social value created by reallocating spectrum currently used for TV broadcast to wireless broadband uses. The long run benefits from enabling more mobile broadband at lower cost are far more important to American society. In fact, past research into the benefit to consumers generated by spectrum deployed for wireless broadband has generally found it to be 10 to 20 times the value of the spectrum to producers.

Several empirical studies have found that the *annual* consumer surplus generated from wireless broadband services enabled by a spectrum allocation is roughly equal to *total* market value of the spectrum allocation (also equal to producer surplus). Table 1 summarizes these results. Based on these findings, the annual consumer surplus from a spectrum band is generally equal to its spectrum value.

Next, the total consumer surplus generated by a spectrum band is the present value of the stream of annual consumer surplus; and the ratio of consumer surplus to spectrum value is simply this present value, divided by the spectrum value. Consequently, the present value of consumer surplus from a spectrum allocation depends critically on the discount rate used. Some would

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45 Andrew Lee, Simona Jankowski, Brett Feldman, Tim Boddy, Doug Clark, Alexander Duval, and Joshua Mills, "Fixed is the New Mobile," The Goldman Sachs Group, Inc., January 15, 2015, page 14. (Herein, "Goldman Report.")

46 Goldman Report, page 23; Kevin Fitchard, "What's Next for Sprint and T-Mo? It's All about the Spectrum Auction, Baby," Gigaom, August 7, 2014, available at https://gigaom.com/2014/08/07/whats-next-for-sprint-and-t-mo-its-all-about-the-spectrum-auction-baby/.

47 Goldman Report, page 8.

48 Statista: The Statistics Portal, "Wireless Telecommunications Carriers (NAICS 51332) in the United States From 2009 to 2014."

argue for a social discount rate of 5%.[49] In this case, the ratio of consumer surplus to spectrum value is 20-to-1. A more conservative discount rate would be 10%, a few points above the average cost of capital in the wireless industry.[50] A 10% discount rate implies a ratio of 10-to-1. Clearly, in the current economic environment, the lower end of this range of discount rates implying the larger ratio of consumer surplus to market value seems more likely.

Based on these results, the total consumer surplus generated by $60 billion of spectrum is equal to between $600 billion (using a 10% discount rate) and $1.2 trillion (using a 5% discount rate).

Table 1. Empirical Results on Ratio of Consumer Surplus to Spectrum Value

		Annual Consumer Surplus ($ Billion)	Total Spectrum Value ($ Billion)	Annual Surplus to Value Ratio	PV of Consumer Surplus ($ Billion)	PV of Consumer Surplus ($ Billion)	PV Surplus to Value Ratio	PV Surplus to Value Ratio
					5% Discount	10% Discount	5% Discount	10% Discount
		[a]	[b]	[c]	[d]	[e]	[f]	[g]
[1]	Hazlett & Munoz (2004)	24.0	27.0	0.9	480	240	18	9
[2]	Hazlett & Munoz (2009)	8.8	9.1	1.0	176	88	19	10
[3]	Rosston (2003)	30.0 - 50.0	30.0	1.0 - 1.7	600 - 1000	300 - 500	20 - 33	10 - 17

Sources:
[1][a]-[1][b]: T. W. Hazlett and R. E. Munoz, "A Welfare Analysis of Spectrum Allocation Policies," Joint Center: AEI-Brookings Joint Center for Regulatory Studies (August 2004).
[2][a]-[2][b]: T. W. Hazlett and R. E. Munoz, "A Welfare Analysis of Spectrum Allocation Policies," RAND Journal of Economics Vol. 40 No. 3 (2009): 424-454.
[3][a]-[3][b]: G. L. Rosston, "The long and winding road: the FCC paves the path with good intentions," Telecommunications Policy 27 (2003): 501-515.
[c]: [a] / [b].
[d]: [a] / 0.05.
[e]: [a] / 0.10.
[f]: [d] / [b].
[g]: [e] / [b].

C. FORWARD AUCTION ESTIMATES

The cost of delaying the Incentive Auction is tied to the benefits from a successful auction, which, as noted above, is at least partially reflected in the revenues raised from the auction. In this section, we use estimates of forward auction revenues as a basis for estimating the total societal welfare expected from the Incentive Auction. The expected price of spectrum also informs expectations about future capital expenditures since carriers will deepen their infrastructure in response to higher spectrum costs. Additionally, forward auction revenues,

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[49] See T. W. Hazlett and R. E. Munoz, "A Welfare Analysis of Spectrum Allocation Policies," Joint Center: AEI-Brookings Joint Center for Regulatory Studies (August 2004), page 18.

[50] Cost of Capital varies by telecommunications sectors, but is generally below 10% for established players. Aswath Damodaran calculates the following sector cost of capitals: Telecom (Wireless) 5.55%, Telecom Equipment 8.69%, and Telecom Services 6.31%. See "Cost of Capital by Sector (US)" available at http://pages.stern.nyu.edu/~adamodar/ (last visited February 5, 2015).

after covering reverse auction costs, potentially provide money to the Treasury, and delays in income to the federal government are costly.

Prior to the recent AWS-3 auction, it was widely believed that $1.50/MHz-pop represented a reasonable estimate of average spectrum license values in the forward auction.[51] In the recently concluded AWS-3 auction, the average price for paired spectrum was $2.65/MHz-pop, with some bands going for as much as $2.84/MHz-pop.[52] These prices are two to three times pre-auction expectations for the AWS-3 band.[53]

The AWS-3 auction prices represent new information that requires a significant upward revision to all spectrum price expectations.[54] Just how much to increase expectations about the Incentive Auction depends on how much of the upward surprise in AWS-3 prices was specific to the AWS-3 band and how much is attributable to broader trends that are applicable to all spectrum bands used to provide wireless broadband services. Both effects are likely needed to explain AWS-3 prices.

The most salient difference between AWS-3 spectrum and the 600 MHz spectrum that will be available in the Incentive Auction is timing of the availability of the frequencies.[55] Carriers will

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51 Jim Cicconi, "AT&T Statement on FCC's Spectrum Aggregation and Auction Eligibility Order," AT&T Public Policy Blog, May 15, 2014, available at http://www.attpublicpolicy.com/fcc/att-statement-on-spectrum-aggregation-and-auction-eligibility-order/; Greenhill and Co., "Incentive Auction Opportunities for Broadcasters," PowerPoint Presentation, October 2014, available at http://wireless.fcc.gov/incentiveauctions/learn-program/docs/ia-opportunities-book.pdf.

52 Stephen Wilkus of Spectrum Financial Partners. (January 30, 2015) *Auction 97 Final Results Through Round 341 Jan 29, 2015*, retrieved from https://www.youtube.com/watch?v=iM32ZSvSyIY, at 5:11.

53 The FCC set a total reserve price for the AWS-3 auction of $10.587 billion. With the price of spectrum in the AWS-3 auction expected to be $1.50/MHz-pop analysts estimated that the auction could raise as much as $20.15 billion, less than half the amount that was actually raised. Phil Goldstein, "AT&T, Verizon, T-Mobile, Dish, and Smaller Carriers Line Up for AWS-3 Auction," Fierce Wireless, October 2, 2014, available at http://www.fiercewireless.com/story/verizon-att-t-mobile-dish-and-smaller-carriers-line-aws-3-auction/2014-10-02; Armand Musey, "FCC Auctions May Disappoint – Supply of Money Less Than Supply of Spectrum," Goldin Associates Blog, April 22, 2014, http://summitridgegroup.com/fcc-auctions-may-disappoint-supply-of-money-less-than-supply-of-spectrum/.

54 Because the different bands of spectrum used to provide wireless broadband services all compete in the same end market of retail wireless broadband services, prices of all such bands are connected. We refer to this as the sea level aspect of spectrum prices. See, Bazelon & McHenry (2013).

55 An additional potential difference between the value of AWS-3 and 600 MHz frequencies is related to the usefulness of the frequencies in a capacity focused build out. See, "MIMO: An Overview", High Frequency Designs, December 2011, available at http://www.highfrequencyelectronics.com/Dec11/1112_HFE_mimoOver.pdf; Peter Rysavy, "Learn How Technology Will Turn Less Desirable Airwaves into 'Beachfront' Spectrum," Gigaom, June 28,

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begin to be able to access the AWS-3 spectrum later this year;[56] the repurposed TV frequencies will generally not be available until over 3 years after the conclusion of the Incentive Auction.[57] There is no clear-cut difference between the availability of all the frequencies in the AWS-3 band and the repurposed TV spectrum, but in general, relative to when it was auctioned, the AWS-3 band will be available a few years sooner.

A time premium of even two years can have a significant impact on spectrum value. In all auctions, prices are set by marginal bidders, or those whose decision to reduce demand stops prices from rising.[58] Consequently, it is these bidders' behavior that set prices. A plausible assumption for the cost of capital for a marginal bidder is 15%, especially if these bidders are not traditional industry players. In this case, a two-year delay in the availability of spectrum would, all else equal, reduce the value of the spectrum by roughly one-quarter.[59] A lower discount rate of 10% and a three year delay suggests similar discounts.[60]

Taking into account the experience in the AWS-3 auction, as well as timing and other issues that would likely influence spectrum value in the AWS-3 and Incentive Auction, we estimate that the Incentive Auction will raise at least $2.00/MHz-pop as a national average. Although there are reasons to believe Incentive Auction prices might be higher,[61] we use the lower end of the likely range. This approach is conservative because the higher the value in the Incentive

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2013, available at https://gigaom.com/2013/06/28/learn-how-technology-will-turn-less-desirable-airwaves-into-beachfront-spectrum/.

56 This is generally true for the downlink frequencies. For example, AT&T recently stated that it expects to initially use the additional AWS-3 spectrum for supplemental downlink. See AT&T Inc., "AT&T Adds High-Quality Spectrum to Support Customers' Growing Demand for Mobile Video and High-Speed Internet," AT&T Newsroom, January 30, 2015, available at http://about.att.com/story/att_adds_high_quality_spectrum_to_support_growing_demand_for_mobile_video_and_high_speed_internet.html. It is also true for portions of the uplink frequencies.

57 Winning broadcast television stations in the reverse auction will have up to 39 months to move once the forward auction concludes. Federal Communications Commission, "Broadcast Incentive Auction 101," PowerPoint Presentation, June 25, 26, & 27 2014, available at http://wireless.fcc.gov/incentiveauctions/learn-program/Broadcast_Incentive_Auction_101_slides.pdf.

58 As with most items sold, most buyers value the item more than its price—it is only the marginal buyer whose value of the item is approximately equal to its price.

59 With an assumed 15% cost of capital, then over two years the price of spectrum will be discounted by the factor $\frac{1}{1.15^2} = 0.756$ which results in the price of spectrum being reduced by $1 - 0.756 = 0.244$, or 24% .

60 With an assumed 10% cost of capital the over three years the price of spectrum will be discounted by the factor $\frac{1}{1.1^3} = 0.751$ which results in the price of spectrum being reduced by $1 - 0.751 = 0.249$, or 25%.

61 Historically, lower band spectrum has sold for a premium.

Auction, the greater the costs from delay. If the 126 MHz clearing scenario prevails in the Incentive Auction, 100 MHz of repurposed frequencies will be sold in the forward auction with an estimated value of $62 billion.[62] Spectrum values, and total bids, could be higher.[63]

D. Economic and Welfare Costs of Delay

A delay in the Incentive Auction would also forgo or delay the economic and consumer welfare benefits discussed above. More than simply postponing these benefits, delaying the Incentive Auction would forgo considerable economic and social value. For every year that the Incentive Auction is delayed, the deployment of this spectrum for wireless broadband services is also set back. These "lost years" represent unrealized net revenues and consumer surplus from wireless mobile services that can never be recovered. This implies lost economic value and social welfare.

Delaying the Incentive Auction could also delay and diminish the indirect and social benefits attributed to the spectrum. To the extent that delaying the availability of spectrum defers the entry of new competitors or the network expansion of existing carriers, a delay could diminish the competitiveness of the wireless industry. Moreover, the availability of less spectrum could stall or curb the pace of innovations in associated industries, like mobile health, mobile apps and wearable devices.

As discussed above, several empirical studies have found that the annual consumer surplus generated by spectrum deployed for mobile broadband is equal to the value of the spectrum. Consequently, every year that the auction is delayed amounts to a loss in consumer surplus roughly equal to the value of the spectrum, if it had been sold. Assuming the spectrum is worth roughly $2.00/MHz-pop or $62 billion for the 126 MHz clearing scenario, a similar amount—$62 billion—would be the *annual* cost of delay. Larger or smaller clearing scenarios would have similarly larger or smaller costs of delay.

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62 $2.00/MHz-pop × 100 MHz × 311 million pops = $62.2 billion.

63 All else equal, the greater the supply of spectrum the lower its price. The difference between a 600 MHz auction that sells 70 megahertz of spectrum versus 120 megahertz (or 20 megahertz) will increase (decrease) the total supply of spectrum by 7% (50 megahertz change/700.5 total megahertz). With an assumed an own-price elasticity of -1.2 this suggests an impact on the total supply of spectrum of roughly 6% (7.14% change in spectrum supply/1.2 assumed own-price elasticity). Total supply of spectrum includes the 580.5 megahertz reported in the FCC's Seventeenth Report on Mobile Wireless, 50 megahertz of paired spectrum from the AWS-3 auction and 70 megahertz of spectrum from the Incentive Auction's mid case clearing scenario. For more information on the total supply of spectrum see "Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993" and "Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless, Including Commercial Mobile Services," WT Docket No. 13-35, Seventeenth Report (rel. December 18, 2014), at page 50. For evidence on the assumed -1.2 own-price elasticity for spectrum see Coleman Bazelon, "Analysis of an Accelerated Digital Television Transition," Analysis Group, May 31, 2005.

Table 2: Annual Consumer Welfare Loss from Delaying Incentive Auction

		Delay		
		1 Year	2 Years	3 Years
[1]	Total Cost of Delay (billions)	$ 62	$ 124	$ 187

Sources and Notes:
[1]: ($2.00/MHz-Pop x 100 MHz x 311 million in US population) x (Years of Delay) / 1,000.

Table 2 reports the costs of delaying the incentive auction for one, two and three years. The annual costs of a one-year delay are equal to $62 billion and these costs increase each year the auction is delayed. If delayed past 2016, a two to three year delay seems most plausible given the presidential election cycle. The election of a new president in 2016 will result in the appointment of both a new FCC chairman, new commissioners and their staff. The cost of a two to three year delay of the Incentive Auction ranges from $124 billion to $187 billion.

Delay in funds for the federal government creates additional costs. Every dollar from the Incentive Auction received by the Treasury will go to deficit reduction.[64] Delay in receiving these funds creates interest costs. It is unclear how much revenue from the Incentive Auction will go to deficit reduction, but it could easily be measured in multiples of $10 billion. Even at a 2% borrowing cost, every year of delay creates $200 million in unnecessary cost for each $10 billion the government will receive.

III. Benefits of Delay?

The costs of delay elaborated above should be weighed against any potential benefits of delay. As noted, some have argued that delaying the Incentive Auction would increase participation by allowing winners from the AWS-3 auction time to recapitalize and that the FCC would develop clearer, more transparent and simpler rules given additional time. Therefore, the potential benefits of delay are the prospects for an improved auction outcome over one held without delay. The question, then, is how at risk is the Incentive Auction if it proceeds as scheduled in 2016? The answer, as described below, is not very.

Taking the concern regarding auction transparency and simplicity first, it seems unlikely that additional time will lead to improved or simpler rules. Broadcaster representatives praised the AWS-3 auction for its transparency.[65] The FCC's Incentive Auction is unlikely to become more

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64 This is so because the auction is already authorized and in the federal budget baseline.

65 Mace Rosenstein, Counsel for Fox Television Stations, Inc., ION Media Networks, Inc., Tribune Media Company and Univision Communications Inc., "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions" and "Broadcast Incentive Auction Comment

Continued on next page

transparent with additional time. The FCC has a strong history of clear and transparent auction rules and there is no indication that they will not do the same here. It also seems doubtful that additional time will lead to additional issues being addressed that will simplify the rules.

The remaining concern is that revenues from an auction held in 2016 would be less than from an auction held at a later date. As detailed below, we believe that an auction held in 2016 will be robust and realize full value from spectrum for at least 6 reasons.

- First, the projected auction revenues of $62 billion or more are fully supported by the economic realities of the wireless industry.
- Second, the bidders in the AWS-3 auction are rational actors who would not have bid in a manner inconsistent with the upcoming Incentive Auction.
- Third, there are many potential bidders, well beyond the 3 to 5 most cited likely auction participants.
- Fourth, FCC auctions are designed so that it only takes a little excess demand to drive prices to their full value.
- Fifth, the spectrum purchases envisioned in the Incentive Auction are large, but not disproportionately so given usual industry churn in spectrum ownership.
- Sixth, spectrum from the Incentive Auction is already included in industry expectations.

A. INDUSTRY ECONOMICS SUPPORT THE VALUE OF MORE SPECTRUM

The wireless industry is robust and growing. Consequently, the industry can support payments of $62 billion, or more, for spectrum. The value of spectrum is the present value of future profits that can be earned from that spectrum.[66] A profitable industry can support significant investment in spectrum.

Wireless telecommunications revenues exceeded $200 billion in 2014[67] and in 2015 are expected to grow by slightly more than 2% to 4%.[68] Currently, industry EBIT margins range from 2% to

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Continued from previous page

Public Notice Auction 1000, 1001 and 1002," GN Docket No. 12-268 and AU Docket No. 14-252, *Notice of Ex Parte Communications* (February 6, 2015).

66 Bazelon and McHenry (2013).

67 Statista: The Statistics Portal, "Wireless Telecommunications Carriers (NAICS 51332) in the United States From 2009 to 2014." In 2013, CTIA reported that the wireless industry had revenues of $189 billion. See CTIA, 2013, "Wireless Industry Survey," available at, http://www.ctia.org/docs/default-source/Facts-Stats/ctia_survey_ye_2013_graphics-final.pdf?sfvrsn=2.

68 Larry Darrell, "Moody's 2015 Outlook: AT&T, Verizon Will Maintain Top Position; Sprint Corporation to Stabilize," Bidness, December 8, 2014, available at http://www.bidnessetc.com/30428-moodys-2015-outlook-att-verizon-will-maintain-top-position-sprint-corporati/.

15% of revenues.[69] Assuming industry margins of 15%,[70] annual industry revenues of $200 billion growing at 3% per year, and an industry discount rate of 10%[71] conservatively implies an NPV of industry profits equal to $471 billion.[72]

The 126 MHz clearing scenario, which would add 100 MHz to the existing base of broadband spectrum, would represent at least 14% of the available frequencies.[73] Fourteen percent of industry profits of $471 billion would be almost $65.9 billion, roughly the expected value of the Incentive Auction spectrum. The 600 MHz spectrum would likely be a larger share of the value of all spectrum because the existing base of spectrum includes clearly lower valued bands such as SMR, WCS and BRS. Furthermore, the NPV of industry profits is likely greater than $471 billion.[74]

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69 As represented by 2014 EBIT margins. Range of industry margins includes margins for Verizon, AT&T, DISH, T-Mobile, and Sprint. Revenue and EBIT values downloaded from Capital IQ on February 13, 2015.

70 Overall industry EBIT margins from our sample were 12% in 2014. Currently, carriers are expending capital at higher than usual rates related to LTE network buildout. Higher than normal capital spending has reduced current margins somewhat as amortization and depreciation are ramped up ahead of increases in revenue. Consequently, we believe 15% margins are more representative of long term industry profitability.

71 The most recent weighted average cost of capital (WACC) estimates suggests that WACC currently varies from 5.4% (Sprint) to 7.1% (DISH). Other players in the wireless industry have WACCs of 6.1% (Verizon), 5.9% (AT&T), and 6.6% (T-Mobile). WACC values downloaded from Bloomberg on February 13, 2015. Cost of Capital varies by telecommunications sectors, but is generally below 10%. Aswath Damodaran calculates the following sector specific Cost of Capital: Telecom (Wireless) 5.55%, Telecom Equipment 8.69%, and Telecom Services 6.31%. The average cost of capital across Telecom Equipment and Telecom Services (wireless was not reported until 2013 and utility was not reported until 2010) was between 8.9% and 16.5% through 2007. It was not until 2008 that the average cost of capital across these two sectors fell below 10%. See "Cost of Capital by Sector (US)" available at http://pages.stern.nyu.edu/~adamodar/ (last visited February 5, 2015). It could be higher for new entrants, but the current analysis of industry wide metrics is based on incumbent industry metrics.

72 $471 billion = $200 billion × 15% × 15.7, where 15.7 = (1+10%) / (10% - 3%). A lower discount rate would imply a higher NPV.

73 Prior to the AWS-3 auction, the FCC spectrum screen included 580.5 MHz; with the paired AWS-3 spectrum the pre-Incentive Auction total would be 630.5 MHz. The addition of 100 MHz of 600 MHz spectrum would bring the total to 730.5 MHz. Of that amount, the 600 MHz spectrum is 14% (100/730.5). See "Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993" and "Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless, Including Commercial Mobile Services," WT Docket No. 13-35, Seventeenth Report (rel. December 18, 2014).

74 $471 billion was calculated above based on an industry discount rate of 10%. This was a conservative assumption because true industry discount rates are probably lower. At 8% the NPV of industry profits would be $648 billion.

B. Bidders Are Rational Actors

Bidders are rational economic actors. As such, bidders focus on maximizing the returns on their investments. This is true across auctions as well as within an auction. At the time of the AWS-3 auction, the FCC's deadline of early 2016 was well known.[75] Consequently, bidders in the AWS-3 auction knew that there would be another opportunity to purchase spectrum in about a year. It would be irrational for them to bid up prices in the AWS-3 auction if doing so would, as proponents of delay suggest, severely depress prices in the upcoming Incentive Auction.

As discussed above, while there are reasons that prices in the AWS-3 auction might be higher than in the Incentive Auction, the price of spectrum across both auctions is connected. After adjustments for timing of availability and spectrum bands are made, their values are inherently tied to each other. Since both spectrum allocations will be used for similar wireless broadband services, the value of both bands will be based on the future profits (common revenues less band specific costs) from these services.

Bidders place bids in an auction mindful of their alternatives outside of the auction. For example, if prices get too high, a bidder may decide its capital is better used to deploy a denser network on its existing spectrum and withdraw from the auction. An important alternative to buying spectrum in any auction is the option to buy spectrum in another auction or through a private sale. AWS-3 bidders knew that they could purchase spectrum in the Incentive Auction a year later. Consequently, bidders were already optimizing their bidding decisions across both auctions during the AWS-3 auction.

C. Potential Bidders

Previous FCC spectrum auctions have attracted hundreds of bidders. See Appendix Tables A-1, A-2 and A-3 for the bidders in the AWS-1, 700 MHz and AWS-3 auctions, respectively. Although many of those bidders expressed only limited demand in the auctions, cumulatively they represented an enormous demand.[76] In fact, several bidders have brought significant individual demand. For example, across these three auctions, AT&T has bid $26.2 billion and

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[75] In October, 2014 the FCC announced that it planned to accept Incentive Auction applications in the fall of 2015 and begin the auction in early 2016. Gary Epstein, "Incentive Auction Progress Report," Official FCC Blog, October 24, 2014, available at http://www.fcc.gov/blog/incentive-auction-progress-report. As recent as early February 2015 the media were still citing early 2016 as the expected start date of the Incentive Auction. See Thomas Gryta, "FCC Sets Opening Bids for Auction of Wireless Airwaves," The Wall Street Journal, February 6, 2014, available at http://www.wsj.com/articles/fcc-sets-opening-bids-for-auction-of-wireless-airwaves-1423243888.

[76] For further discussion on excess demand in an auction, see Robert J. Shapiro, Douglas Holtz-Eakin and Coleman Bazelon, "The Economic Implications of Restricting Spectrum Purchases in the Incentive Auction," Georgetown University McDonough School of Business, Center for Business and Public Policy, April 30, 2013, available at http://www.gcbpp.org/files/Academic_Papers/EconImplicationsSpectrumFINAL.pdf.

Verizon has bid $22.6 billion.[77] Furthermore, as discussed below, Craig McCaw's experience in the Broadband PCS auction illustrates that a bidder with only limited interest can have a significant impact on final prices.[78] Consequently, the existence of many bidders, even if they do not have significant resources available can have a profound impact on auction prices.

As in previous auctions, we expect primarily 4 types of bidders—all with financing and motive to bid competitively—to participate in the Incentive Auction. Tier 1 firms are nationwide wireless broadband service providers, including Verizon, AT&T, Sprint, and T-Mobile. As demand for their wireless services grows, these firms have an increasing need for additional spectrum. For both Verizon and AT&T the Incentive Auction will likely be the last unrestricted chance for them to acquire low-band spectrum and the historic success of the two firms will give them reliable access to capital for use in the auction.[79] Furthermore, especially outside of urban areas, Sprint and T-Mobile have relatively little spectrum below 1 GHz for expanding their existing network coverage.[80] T-Mobile saw revenues grow 7% in 2014 and is also forecasting an increase in cash flows for 2015 giving T-Mobile more access to capital markets.[81] Finally, SoftBank has more than $20 billion in cash on hand and is predicted to be able to fund Sprint's participation in the Incentive Auction.[82] As Table 3 illustrates, these firms have substantial value and the financial resources to participate in an auction.

It is also worth noting that previous auctions have not been dependent on the presence of all nationwide providers in order to be competitive. For instance, both Sprint and T-Mobile chose not to enter the 700 MHz auction and Sprint also sat out the AWS-3 auction. In both cases, the auctions were considered successful even without their participation.

In addition to the large, nationwide providers, there are also a variety of regional and multi-regional wireless service providers who currently hold spectrum licenses and offer wireless

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77 AT&T bid $1.3 billion in Auction 66 under the name Cingular AWS, LLC, $6.6 billion in Auction 73 under the name AT&T Mobility Spectrum, LLC and $18.2 billion in Auction 97 under the name AT&T Wireless Services 3 LLC, respectively. Verizon bid $2.8 billion in Auction 66, $9.3 billion in Auction 73 and $10.4 billion in Auction 97 all under the name Cellco Partnership d/b/a Verizon Wireless. See Appendices A-1, A-2 and A-3.

78 Peter Cramton, "The FCC Spectrum Auction: An Early Assessment," Journal of Economics and Management Strategy, 6:3, pages 431-495, 1997.

79 Kagan White Paper, pages 15-25.

80 Together, Verizon and AT&T hold over 70% of the 700 MHz spectrum. The two carriers operate 700 MHz spectrum that serves a total population of over 630 million while T-Mobile's 700 MHz can only serve a population of roughly 175 million and Sprint operates no 700 MHz spectrum. See "Policies Regarding Mobile Spectrum Holdings" and "Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions," WT Docket No. 12-269 and Docket No. 12-268, *Report and Order*, FCC 14-63 (rel. June 2, 2014), at paragraph 46; Kagan White Paper, Exhibit A.

81 Kagan White Paper, at pages 26-27.

82 *Ibid,* page 31.

broadband services throughout the U.S. Many of these players are well known, and financially situated to participate. Table 3 lists some these Tier 2 firms, including U.S. Cellular, Appalachian, nTELOs, Bluegrass, and Atlantic Tele-Network. Many of these other players have expressed significant demand in prior auctions, including approximately $9 billion of unmet demonstrated willingness to bid in the 700 MHz auction.[83] As is illustrated in Appendix Tables A-1, A-2 and A-3, many of these regional providers have participated in auctions before. Many of these firms appear to be in a strong position to invest in additional spectrum.

Table 3. Examples of Potential Bidders

Firm	Enterprise Value [1] ($ Billions)	Not Publicly Traded
	Tier 1	
AT&T	$249.70	
Verizon	$300.85	
Sprint	$44.73	
T-Mobile US	$44.71	
	Tier 2	
U.S. Cellular (TDS)	$3.77	Appalachian Wireless
nTELOs	$0.51	Bluegrass
Atlantic Tele-Network	$0.70	Telapex
	Related Industry	
Microsoft	$280.45	
Google	$310.41	
Intel	$160.37	
Comcast	$186.02	
Qualcomm	$92.67	
Dish Network	$39.47	
EchoStar	$5.48	

Source:
[1]: http://finance.yahoo.com, last accessed February 4, 2015.

[83] See Bazelon, "Too Many Goals" (2009), page 126.

Also noted in Table 3, in addition to service providers there are related industry players who have participated in spectrum auctions in the past. The strong bidding of DISH network in the recent H-Block and AWS-3 auctions illustrates an important point—significant sums can be brought to an auction by firms other than the leading 4 wireless providers. For instance, Google and Qualcomm have both participated in spectrum auctions before, putting billions of dollars at risk in auctions. Microsoft, Facebook and Amazon have also expressed interest in the wireless broadband sector and related technologies.

Finally, as Table 4 outlines, a number of investment firms have also expressed interest in the telecommunications sector. Encouraged by FCC rules that allow leasing and other secondary market transactions, Wall Street now recognizes spectrum as a strategic asset and has shown a willingness to invest in spectrum licenses. These investment groups bring significant capital to the table. They stand ready to enter the market for spectrum when the asset is underpriced.

Table 4. Examples of Investment Groups Interested in Telecommunications

	Firm	Assets Under Management	Size
[1]	Alinda Capital	$7 billion under management	11-50 employees
[2]	Anderson Pacific	Unknown	Investments in 10 firms in the media and telecommunications industry
[3]	Abry Partners	$3.5 billion in active funds	Investments range from $25 million to $150 million
[4]	Bain Capital	$80 billion under management	Unknown
[5]	Battery Ventures	Raised $4.5 billion since inception; currently investing in a $900 million fund	Unknown
[6]	Berkshire Partners	$11 billion under management	Over 100 employees and 113 private equity investments made
[7]	Blackstone	$290 billion under management	Over 2,000 employees in 22 offices
[8]	Carlyle Group	$203 billion under management	1,700 employees in 40 countries; 129 funds
[9]	Catalyst Investors	Unknown	Size of investments range from $10-$40 million
[10]	Charlesbank Capital	$3 billion under management	43 employees and 72 companies invested in
[11]	Columbia Capital	$2.5 billion under management	Funded over 150 companies since 1989
[12]	Court Square	$6 billion under management	Invested over $4.5 billion in more than 150 transactions, which have returned $14 billion to date
[13]	General Atlantic	$8 billion committed capital, $12 billion portfolio	Over 200 employees
[14]	GI Partners	$2.6 billion under management	17 employees
[15]	Great Hill Partners	Unknown	More than 50 portfolio company investments, nearly $3 billion of arranged portfolio financings
[16]	KKR	$96.1 billion under management	21 offices world-wide, 44 investment funds raised since inception
[17]	Madison Dearborn Partners	Raised over $18 billion since its formation in 1992	Completed investments in approximately 125 companies since 1992
[18]	M/C Partners	Managed over $1.5 billion since founding	Investments range from $5 million to $50 million
[19]	Oak Hill Capital Partners	$8 billion under management	Over 70 transactions since the mid-1980s
[20]	Pamlico Capital	$2 billion under management	16 investment professionals
[21]	Providence Partners	$40 billion under management	250 employees; invested in over 140 companies
[22]	Ridgemont Equity	$735 million in commitments	Investments of $25 million to $100 million
[23]	Seaport Capital	Unknown	Equity investments between $5 and $20 million
[24]	Silver Lake	$23 billion under management	110 investment professionals
[25]	TA Associates	$18 billion raised since inception	80 investment professionals; investments range from $50 million to $500 million in equity
[26]	Thermo Capital Partners	Unknown	focused on investments from $5 to $100 million in telecommunications, business services and technology companies
[27]	TPG	$65 billion under management	18 offices world-wide

Sources (last accessed February 19, 2015):

[1]: https://www.linkedin.com/company/alinda-capital-partners-llc
[2]: http://andersonpacific.com/portfolio/
[3]: http://www.abry.com/AboutUs/OurFunds.aspx
[4]: http://www.baincapital.com/about-bain-capital
[5]: http://www.battery.com/about-us/
[6]: http://www.berkshirepartners.com/background-and-history
[7]: http://www.blackstone.com/the-firm/overview
[8]: http://www.carlyle.com/about-carlyle
[9]: http://www.catalyst.com/about-us/investment-criteria
[10]: http://www.charlesbank.com/about-us/our-history/
[11]: http://www.colcap.com/about/overview
[12]: http://www.courtsquare.com/?#/about_us/
[13]: http://www.generalatlantic.com/about-us/the-ga-difference/?
[14]: http://gipartners.com/overview/introduction
[15]: http://www.greathillpartners.com/about
[16]: http://www.kkr.com/our-firm/kkr-today
[17]: http://www.mdcp.com/overview/
[18]: http://www.mcpartners.com/
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[22]: http://www.ridgemontep.com/
http://www.ridgemontep.com/investments/
[23]: http://www.seaportcapital.com/focus
[24]: http://www.silverlake.com/secondary.asp?pageID=1
[25]: http://www.ta.com/About-TA/Overview.aspx
http://www.ta.com/About-TA/Investment-Profile.aspx
[26]: http://www.thermocapitalpartners.com/
[27]: https://tpg.com/

D. FCC Auctions are Designed to Achieve Full Value

FCC auction design has evolved over the past two decades. The simultaneous multiple round format was innovative when the FCC first deployed it in 1994. It was also a resounding success. The format has changed since then in an effort to continuously improve the efficiency of auctions. A key objective of the auction design is to encourage bidders to express their true valuations of the spectrum licenses being sold. For this to happen, there must be excess demand in the auction—but there does not have to be much excess demand.

The proposition that there does not need to be much excess demand in an auction to drive up auction bids was illustrated by Craig McCaw in the original Broadband PCS auction (Auction #4). As Peter Cramton noted,[84]

> McCaw apparently recognized that in some markets there might not be enough deep-pocketed bidders for prices to reach full value. By putting down just $33 million in earnest money, McCaw gained eligibility to bid in many large markets. At almost no cost (the lost interest on the $33 million upfront payment), McCaw was buying the option to step in and snatch licenses that were underpriced because of a lack of competition.

Cramton estimates that in the markets where McCaw bid, and bidding for that market ended when he dropped out, the difference between the price McCaw set and the price that would have been set by the next highest bidder totaled $825 million.[85] That is, a bidder with a $33 million deposit placed bids that increased final license prices by 25 times that amount.

E. Spectrum Purchases In Context

To evaluate the ability of potential purchasers of spectrum licenses to buy auctioned spectrum, it is useful to look at the overall market for spectrum purchases. Purchased spectrum includes not only licenses won at FCC auctions, but also includes licenses purchased in the secondary market. Together, they represent the amount of money spent by firms on spectrum licenses.

The earlier discussion of the sources of spectrum value (future economic profits) was not dependent on the spectrum coming from an FCC auction versus coming from a secondary market transaction. Both auctions and the secondary market represent significant purchases of spectrum. See Table 5. What is notable is the high level of annual turnover of spectrum licenses. The total churn of spectrum would be larger if other bands, including Cellular, SMR, and BRS

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84 Peter Cramton, "The FCC Spectrum Auction: An Early Assessment," Journal of Economics and Management Strategy, 6:3, 431-495, 1997, page 17.

85 Peter Cramton, "The FCC Spectrum Auction: An Early Assessment," Journal of Economics and Management Strategy, 6:3, 431-495, 1997, page 18.

were included. The total amount spent by private entities on spectrum licenses was just over $353 billion from 2000 through early 2015 or just over $22 billion per year. Spending 2-3 times that long-term average in a single year does not seem exceptional.

Table 5. Spectrum Transactions (in billions)

Year	AWS Spectrum Traded (Select Transactions) [1]	700 MHz Spectrum Traded (Select Transactions) [2]	PCS Spectrum Traded (2000-2008) [3]	Auctions of PCS, AWS, and 700 MHz Spectrum [4]	Total [5]
2000			$44.74	$0.52	$45.26
2001			$22.26	$0.03	$22.29
2002			$8.23	$0.09	$8.32
2003			$17.14	$0.06	$17.20
2004			$22.94		$22.94
2005			$12.41	$2.04	$14.45
2006			$20.91	$13.70	$34.61
2007			$46.99	$0.01	$47.01
2008	$0.10	$1.93	$58.39	$18.98	$79.39
2009					$0.00
2010					$0.00
2011	$3.93			$0.02	$3.95
2012	$4.82				$4.82
2013	$3.65	$2.09			$5.74
2014	$0.95	$3.32		$1.56	$5.83
2015				$41.33	$41.33
Total	**$13.45**	**$7.33**	**$254.01**	**$78.35**	**$353.14**

Sources and Notes:

[1]: The Brattle Group calculations. Citi Research Spectrum Triangulation Report, June 22, 2014. JP Morgan Telecom Services & Towers Report, December 5, 2012.

[2]: Citi Research Spectrum Triangulation Report, June 22, 2014.

[3]: MHz-Pop from John W. Mayo and Scott Wallsten, 'Enabling efficient wireless communications: The role of secondary spectrum markets,' Information Economics and Policy 22 (2010): 61-72. Multiplied by 2005 Nextel FCC spectrum swap of $1.62/MHz-Pop adjusted using annual average of TTH index before 2005 and annual average of SpecEx index after 2005.

[4]: Total of net bids for applicable auctions from http://wireless.fcc.gov/auctions/default.htm?job=auctions_home.

[5]: [1] + [2] + [3] + [4].

F. Expenditures Consistent With Industry Expectations

As noted above, wireless broadband data is projected to increase 7-fold over the next 5 years.[86] This projected increase is for data carried on the macro cellular network and does not include data offloaded on WiFi networks. Although newer, more efficient technologies and densification of the cellular network can achieve significant increases in capacity, additional spectrum will be needed if these projections are to come true.

Also noted above, industry economics—future industry revenues and profits—also supports the increase in spectrum that the Incentive Auction will create. This view of the value of spectrum is also consistent with the FCC's analysis of the trade-off between spectrum and capital expenditures in the National Broadband Plan.[87] Future expected capacity to meet growing demand for wireless services has to be paid for, either in additional spectrum or, in lieu of spectrum, additional capital expenditures, if feasible.

The success story that is the wireless broadband industry relies on spectrum; the extraordinary anticipated growth of that industry already anticipates additional spectrum from the Incentive Auction.

IV. The Authors

Coleman Bazelon is a principal in the Washington, DC office of The Brattle Group. He is an expert in regulation, strategy and valuation in the wireless, wireline, and video sectors. He has consulted and testified on behalf of clients in numerous telecommunications matters, ranging from wireless license auctions, spectrum management, and competition policy, to patent infringement, business valuation, and broadband deployment.

Dr. Bazelon frequently advises regulatory and legislative bodies, including the U.S. Federal Communications Commission and the U.S. Congress. He also has expertise in the federal government's use of discount rates for policy and regulatory analysis, intellectual property valuation, economic impact analysis, and antitrust and damages analysis.

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86 Cisco VNI Forecast Presentation, slide 5.

87 That analysis from several years ago of the trade-off between spectrum and network capital expenditures suggests that an additional 100 MHz of spectrum would save about $50 billion in required network capital expenditures. Since then, networks have become denser and as a consequence the savings from avoided capital deployments would be greater, making this analysis consistent with our value of about $62 billion for 100 MHz. FCC, "Mobile Broadband: The Benefits of Additional Spectrum," FCC Staff Technical Paper, Exhibit 22.

Throughout his career, Dr. Bazelon has had extensive experience with spectrum license auctions. He advises on and evaluates numerous auction designs and regularly serves as an auction advisor for bidders in spectrum license auctions.

Prior to joining Brattle, Dr. Bazelon was a vice president with Analysis Group, an economic and strategy consulting firm. During that time, he expanded the firm's telecommunications practice area. He also served as a principal analyst in the Microeconomic and Financial Studies Division of the Congressional Budget Office where he researched reforms of radio spectrum management; estimated the budgetary and private sector impacts of spectrum-related legislative proposals; and advised on auction design and privatization issues for all research at the CBO.

Giulia McHenry is a Senior Associate with The Brattle Group. She is an expert in economic and regulatory analysis in the telecommunications and media industries, and antitrust litigation. Since she joined Brattle in 2010, she has consulted on competition in the wireless sector, spectrum management and valuation, broadband deployment, state and federal regulatory proceedings, and Connect America and Universal Service Funds. She has coauthored publications on wireless competition, spectrum value, spectrum sharing, federal incentives for efficient spectrum use, and TV broadcaster revenues. She has filed economic analyses and presented to Federal Communications Commission (FCC) and U.S. Congressional staff on behalf of clients.

Recently Dr. McHenry has coauthored white papers on "Spectrum Sharing: Taxonomy and Economic" (February 2014) and "Canadian Wireless Market Performance and the Potential Effect of an Additional Nationwide Carrier" (May 2014). She has also been advising on most aspects of the upcoming FCC Incentive Auction, from predicting market-by-market prices for TV broadcast licenses and estimating wireless broadband license values, to identifying the implications of key auction rules. She was appointed to the Commerce Spectrum Management Advisory Committee (CSMAC) in 2014.

Prior to joining Brattle, she was a senior economist at the Government Accountability Office (GAO), where she conducted economic analysis related to U.S. international policy, including trade and trade promotion, global financial linkages, and international development. Dr. McHenry received her Ph.D. in economics from the University of Maryland in 2009, and her BA from Wesleyan University in 2001.

Prior to graduate school, Dr. McHenry worked as an analyst at NERA Economic Consulting where she gained extensive experience in price-fixing litigation and merger investigations. She enjoys the art of cooking, reading about tech policy, and translating economics into human language.

Appendix A

APPENDIX A-1
AUCTION 66: BIDDERS AND PWB WINNERS

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
	PWB Winners				
[1]	T-Mobile License LLC	$583,518,750	583,518,750	120	$4,182,312,000
[2]	Cellco Partnership d/b/a Verizon Wireless	$383,343,000	255,562,000	13	$2,808,599,000
[3]	SpectrumCo LLC	$637,709,000	637,709,000	137	$2,377,609,000
[4]	MetroPCS AWS, LLC	$200,000,000	200,000,000	8	$1,391,410,000
[5]	Cingular AWS, LLC	$500,000,000	333,333,334	48	$1,334,610,000
[6]	Cricket Licensee (Reauction), Inc.	$255,000,000	255,000,000	99	$710,214,000
[7]	Denali Spectrum License, LLC	$50,000,000	50,000,000	1	$365,445,000
[8]	Barat Wireless, L.P.	$80,000,000	80,000,000	17	$169,520,000
[9]	AWS Wireless Inc.	$142,830,000	142,830,000	154	$115,503,000
[10]	Atlantic Wireless, L.P.	$52,000,000	52,000,000	15	$100,392,000
[11]	American Cellular Corporation	$17,000,000	17,000,000	85	$65,880,000
[12]	Cincinnati Bell Wireless LLC	$7,000,000	7,000,000	9	$37,071,000
[13]	Cellular South Licenses, Inc.	$7,000,000	7,000,000	12	$33,025,000
[14]	Cable One, Inc.	$3,531,000	3,531,000	30	$22,148,000
[15]	Cavalier Wireless, LLC	$18,800,000	18,800,000	30	$19,943,000
[16]	Daredevil Communications LLC	$8,888,000	8,888,000	14	$13,441,000
[17]	Iowa Telecommunications Services, Inc.	$3,102,000	3,102,000	15	$11,473,000
[18]	Centennial Michiana License Company LLC	$5,000,000	5,000,000	2	$9,134,000
[19]	Red Rock Spectrum Holdings, LLC	$6,000,000	6,000,000	42	$7,466,000
[20]	Public Service Wireless Services, Inc.	$4,501,000	4,501,000	7	$5,480,000
[21]	Central Texas Telephone Investments, LP	$2,567,000	2,567,000	5	$4,940,000
[22]	Hill Country Telephone Cooperative, Inc.	$254,000	254,000	2	$4,700,000
[23]	Carolina West Wireless, Inc.	$6,000,000	6,000,000	9	$4,621,000
[24]	Palmetto Rural Telephone Cooperative, Inc.	$1,242,000	1,242,000	2	$4,483,000
[25]	Plateau Telecommunications, Inc.	$3,000,000	3,000,000	4	$4,200,000
[26]	LL License Holdings II, LLC	$2,500,000	2,500,000	8	$3,435,000
[27]	Triad AWS, Inc.	$40,000,000	40,000,000	5	$3,193,000
[28]	KTC AWS Limited Partnership	$700,000	678,000	11	$3,108,000
[29]	Vermont Telephone Company, Inc.	$563,000	563,000	3	$2,911,000
[30]	CROSS TELEPHONE COMPANY	$1,049,000	1,049,000	3	$2,450,000
[31]	Manti Telephone Company	$563,000	563,000	5	$2,421,000
[32]	Chequamegon Communications Cooperative, Inc.	$1,281,700	1,281,700	3	$2,419,000
[33]	Mediapolis Telephone Company	$250,000	250,000	2	$2,392,000
[34]	MTPCS License Co., LLC	$2,000,000	2,000,000	4	$2,348,000
[35]	NTELOS Inc.	$2,660,000	2,660,000	7	$2,295,000
[36]	MTA Communications, Inc.	$1,220,000	1,220,000	3	$2,251,000
[37]	Command Connect, LLC	$3,300,000	3,300,000	5	$2,210,000
[38]	FMTC Wireless, Inc.	$325,000	325,000	2	$2,197,000
[39]	Spotlight Media Corp	$1,149,000	1,149,000	2	$2,192,000
[40]	NSIGHTTEL WIRELESS, LLC	$1,800,000	1,800,000	5	$2,099,000
[41]	Smithville Spectrum, LLC	$425,000	416,000	2	$2,011,000
[42]	Union Telephone Company	$800,000	800,000	8	$1,948,200
[43]	Blackfoot Telephone Cooperative, Inc.	$782,100	782,100	4	$1,798,000
[44]	Hemingford Cooperative Telephone Company	$750,000	750,000	11	$1,660,000
[45]	West Carolina Piedmont Bidding Consortium	$380,400	380,400	3	$1,642,000
[46]	Wittenberg Telephone Company	$855,000	855,000	3	$1,519,000
[47]	Fidelity Communications Company	$900,000	900,000	7	$1,501,000
[48]	Atlantic Seawinds Communications, LLC	$233,000	233,000	1	$1,477,000
[49]	CTC Telcom, Inc.	$220,000	220,000	1	$1,407,000
[50]	FTC Management Group, Inc.	$243,000	243,000	2	$1,380,000

AUCTION 66: BIDDERS AND PWB WINNERS, Cont.

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
[51]	NEIT Wireless, LLC	$475,000	475,000	3	$1,315,000
[52]	Sandhill Communications, LLC	$133,000	133,000	1	$1,179,000
[53]	Chester Telephone Company	$103,000	103,000	1	$1,100,000
[54]	3 Rivers Telephone Cooperative, Inc.	$821,000	821,000	4	$1,066,000
[55]	AGRI-VALLEY COMMUNICATIONS, INC.	$2,037,000	2,037,000	5	$1,045,000
[56]	Horry Telephone Cooperative, Inc.	$1,012,800	1,012,800	1	$925,000
[57]	Space Data Spectrum Holdings, LLC	$520,000	520,000	3	$777,000
[58]	SKT, Inc.	$814,000	814,000	1	$774,000
[59]	18th Street Spectrum, LLC	$750,000	750,000	4	$751,000
[60]	Blue Valley Tele-Communications, Inc.	$109,000	109,000	2	$711,000
[61]	Southeastern Indiana Rural Telephone Coop., Inc.	$242,400	242,400	1	$658,000
[62]	Hancock Rural Telephone Corporation	$400,000	384,000	1	$629,000
[63]	Pine Cellular Phones, Inc.	$226,000	226,000	2	$601,000
[64]	Telephone Electronics Coporation	$1,338,000	1,338,000	3	$559,000
[65]	Bend Cable Communications, LLC	$176,000	176,000	2	$528,000
[66]	LCDW Wireless Limited Partnership	$150,000	144,000	1	$514,000
[67]	Midwest AWS Limited Partnership	$128,000	128,000	1	$489,000
[68]	Lynch AWS Corporation	$1,500,000	1,500,000	1	$485,000
[69]	CenturyTel Broadband Wireless LLC	$59,098,000	59,098,000	6	$468,000
[70]	Alenco Communications, Inc.	$325,000	325,000	1	$437,000
[71]	Stayton Cooperative Telephone Company	$658,000	658,000	1	$391,000
[72]	James Valley	$75,000	75,000	1	$373,000
[73]	Paul Bunyan Rural Telephone Cooperative	$620,000	620,000	3	$329,000
[74]	Ligtel Communications, Inc.	$300,000	296,000	2	$319,000
[75]	Mutual Telephone Company	$370,000	364,000	1	$312,000
[76]	BEK COMMUNICATIONS COOPERATIVE	$196,000	196,000	2	$312,000
[77]	Comporium Wireless, LLC	$673,000	673,000	1	$295,000
[78]	ETCOM, LLC	$81,000	81,000	1	$283,000
[79]	La Ward Cellular Telephone Company, Inc.	$84,000	84,000	1	$273,000
[80]	Chariton Valley Communication Corporation, Inc.	$131,000	131,000	2	$268,000
[81]	Big River Telephone Company, LLC	$250,000	250,000	2	$243,000
[82]	BPS Telephone Company	$192,000	192,000	1	$228,000
[83]	CCTN BIDDING CONSORTIUM	$140,100	140,100	6	$228,000
[84]	Mt. Vernon. Net, Inc.	$291,000	291,000	1	$227,000
[85]	C&W Enterprises INC.	$141,000	141,000	1	$226,000
[86]	Dakota Wireless Group, LLC	$100,000	100,000	2	$222,000
[87]	Green Hills Area Cellular Telephone, Inc.	$43,000	43,000	1	$213,000
[88]	Innovative Communication Corporation	$97,500	65,000	2	$184,000
[89]	North Dakota Network Company	$581,000	581,000	3	$177,000
[90]	City of Ketchikan dba Ketchikan Public Utilities	$44,000	44,000	1	$157,000
[91]	Big Bend Telecom, LTD	$34,000	34,000	2	$129,000
[92]	Volcano Internet Provider	$89,000	89,000	1	$105,000
[93]	Grand River Communications, Inc.	$103,000	103,000	1	$103,000
[94]	Reservation Telephone Cooperative, Inc.	$37,000	37,000	1	$92,000
[95]	Farmers Telecommunications Cooperative, Inc.	$85,000	85,000	1	$85,000
[96]	Route 66 Wireless, LLC	$500,000	500,000	1	$72,000
[97]	Three River Telco	$88,000	88,000	1	$72,000
[98]	The S&T Telephone Cooperative Association, Inc.	$28,000	28,000	2	$72,000
[99]	PetroCom License Corporation	$60,000	60,000	2	$70,000
[100]	Churchill County Telephone d/b/a CC Communications	$60,000	60,000	2	$60,000
[101]	AST Telecom, LLC	$34,000	34,000	1	$34,000
[102]	Northeast Missouri Rural Telephone Company	$55,000	55,000	1	$28,000
[103]	Northwest Missouri Cellular Limited Partnership	$128,000	128,000	1	$26,000
[104]	WUE INC	$8,000	8,000	1	$8,000
	Subtotal	$3,119,969,750	$2,825,426,584	1,087	$13,879,110,200

AUCTION 66: BIDDERS AND PWB WINNERS, Cont.

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
	Bidders that did not Win a License				
[105]	Wireless DBS LLC	$972,546,000	648,364,000	0	$0
[106]	Dolan Family Holdings, LLC	$149,983,000	149,983,000	0	$0
[107]	Antares Holdings, LLC	$21,000,000	21,000,000	0	$0
[108]	Shenandoah Mobile Company	$4,749,000	4,749,000	0	$0
[109]	PCS Partners, L.P.	$3,000,000	3,000,000	0	$0
[110]	Hawaiian Telcom Communications, Inc.	$2,155,000	2,155,000	0	$0
[111]	Iowa Intelegra Consortium, LLC	$2,000,000	2,000,000	0	$0
[112]	Bluestreak Wireless LLC	$1,000,000	1,000,000	0	$0
[113]	Leaco Rural Telephone Cooperative Inc	$712,500	475,000	0	$0
[114]	St. Cloud Wireless Holdings, LLC	$630,000	630,000	0	$0
[115]	WEST CENTRAL COMMUNICATIONS, LLC	$536,000	536,000	0	$0
[116]	Cal-Ore Telephone Co.	$500,000	500,000	0	$0
[117]	Central Utah Telephone Company	$500,000	500,000	0	$0
[118]	Western New Mexico Telephone Company, Inc.	$500,000	500,000	0	$0
[119]	Craw-Kan Telephone Cooperative, Inc.	$434,000	434,000	0	$0
[120]	Granite State Long Distance, Inc.	$381,000	381,000	0	$0
[121]	Allcom Communications, Inc.	$368,000	368,000	0	$0
[122]	The Chillicothe Telephone Company	$359,000	359,000	0	$0
[123]	South Slope Cooperative Telephone Company, Inc.	$350,000	303,000	0	$0
[124]	West Central Telephone Association	$310,000	294,000	0	$0
[125]	ACS Wireless License Sub, Inc.	$304,000	304,000	0	$0
[126]	Northeast Nebraska Telephone Company	$302,000	302,000	0	$0
[127]	Kingdom Telephone Company	$300,000	300,000	0	$0
[128]	Carolina Personal Communications, Inc.	$286,000	286,000	0	$0
[129]	Advanced Communications Technology, Inc.	$264,000	264,000	0	$0
[130]	Tri-Valley Communications, LLC	$249,000	249,000	0	$0
[131]	XIT Leasing, Inc.	$210,000	210,000	0	$0
[132]	Northern Iowa Communications Partners, LLC	$200,000	200,000	0	$0
[133]	Rodriguez, Marcos	$195,000	195,000	0	$0
[134]	Heart of Iowa Communications Cooperative	$175,000	163,000	0	$0
[135]	Shoreline Investments LLC	$173,000	173,000	0	$0
[136]	MAC Wireless, LLC	$160,000	154,000	0	$0
[137]	Van Buren Wireless, Inc.	$160,000	147,000	0	$0
[138]	Partnership Wireless LLC	$158,000	158,000	0	$0
[139]	WWW BROADBAND, LLC	$157,000	157,000	0	$0
[140]	Ellijay Telephone Company	$154,000	154,000	0	$0
[141]	Jefferson Telephone Company	$150,000	150,000	0	$0
[142]	Wheat State Telephone, Inc.	$141,000	141,000	0	$0
[143]	Graceba Total Communications, Inc.	$138,000	138,000	0	$0
[144]	Arapahoe Telephone Company d/b/a ATC Communication	$136,000	136,000	0	$0
[145]	Perry-Spencer Rural Telephone Coop., Inc. dba PSC	$136,000	136,000	0	$0
[146]	The Pioneer Telephone Association, Inc.	$134,000	134,000	0	$0
[147]	UNITED WIRELESS COMMUNICATIONS INC.	$130,000	130,000	0	$0
[148]	SALINA SPAVINAW TELEPHONE COMPANY, INC.	$125,000	125,000	0	$0
[149]	Ropir Communications, Inc.	$118,000	118,000	0	$0
[150]	Coleman County Telecommunications, LTD	$116,000	116,000	0	$0
[151]	The Tri-County Telephone Association, Inc.	$116,000	116,000	0	$0
[152]	South #5 RSA Limited Partnership d/b/a Brazos Cell	$103,000	103,000	0	$0
[153]	Diller Telephone Company	$101,000	101,000	0	$0
[154]	Aztech Communications, Inc.	$93,000	93,000	0	$0
[155]	Clay County Rural Telephone Cooperative, Inc.	$80,000	76,000	0	$0

AUCTION 66: BIDDERS AND PWB WINNERS, Cont.

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
[156]	Rainbow Telecommunications Association, Inc.	$70,000	70,000	0	$0
[157]	McDonald County Telephone Company	$67,000	67,000	0	$0
[158]	Plains Cooperative Telephone Association, Inc.	$64,000	64,000	0	$0
[159]	Roberts County Telephone Cooperative Association	$61,500	41,000	0	$0
[160]	MUENSTER TELEPHONE CORPORATION OF TEXAS	$55,000	55,000	0	$0
[161]	Farmers Mutual Telephone Company	$43,000	43,000	0	$0
[162]	UNITED TELEPHONE MUTUAL AID CORPORATION	$35,000	35,000	0	$0
[163]	Breda Telephone Corp.	$33,000	33,000	0	$0
[164]	Panora Telecommunications, Inc.	$33,000	33,000	0	$0
[165]	XIT Telecommunication & Technology, Ltd.	$33,000	33,000	0	$0
[166]	Clinker LLC	$20,000	20,000	0	$0
[167]	Beehive Telephone Company, Inc.	$17,000	17,000	0	$0
[168]	Panhandle Telecommunication Systems, Inc.	$17,000	17,000	0	$0
	Subtotal	$1,167,826,000	843,288,000	0	$0

Source: http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=66.

APPENDIX A-2
AUCTION 73: BIDDERS AND PWB WINNERS

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
	PWB Winners				
[1]	Cellco Partnership d/b/a Verizon Wireless	$885,000,000	590,000,000	109	$9,363,160,000
[2]	AT&T Mobility Spectrum, LLC	$500,000,000	333,333,334	227	$6,636,658,000
[3]	QUALCOMM Incorporated	$195,000,000	195,000,000	9	$1,030,184,000
[4]	Frontier Wireless LLC	$115,253,100	76,835,400	168	$711,871,000
[5]	King Street Wireless, L.P.	$97,000,000	97,000,000	152	$400,638,000
[6]	MetroPCS 700 MHz, LLC	$153,681,800	153,681,800	1	$313,267,000
[7]	Cox Wireless, Inc.	$36,000,000	36,000,000	22	$304,633,000
[8]	Cellular South Licenses, Inc.	$29,634,000	29,634,000	24	$191,533,000
[9]	CenturyTel Broadband Wireless LLC	$25,000,000	25,000,000	69	$148,964,000
[10]	Vulcan Spectrum LLC	$52,000,000	52,000,000	2	$112,793,000
[11]	Continuum 700 LLC	$22,665,000	22,665,000	10	$88,179,000
[12]	Cavalier Wireless, LLC	$42,000,000	42,000,000	35	$61,803,000
[13]	Puerto Rico Telephone Company, Inc.	$1,761,600	1,174,400	2	$31,402,000
[14]	Triad 700, LLC	$57,000,000	57,000,000	36	$22,694,000
[15]	MCBRIDE SPECTRUM PARTNERS, LLC	$2,000,000	2,000,000	2	$8,490,000
[16]	Horry Telephone Cooperative, Inc.	$506,000	506,000	1	$8,469,000
[17]	Wireless Communications Venture	$139,000	139,000	1	$8,055,000
[18]	Redwood Wireless Corp.	$3,500,000	3,500,000	5	$7,845,000
[19]	Miller, David	$2,250,000	2,250,000	16	$7,812,000
[20]	Bend Cable Communications, LLC	$187,000	187,000	1	$6,745,000
[21]	Central Texas Telephone Investments, LP	$2,500,000	2,500,000	8	$6,347,000
[22]	I-700, LLC	$2,400,000	2,400,000	8	$5,960,000
[23]	Iowa Telecommunications Services, Inc.	$1,862,000	1,862,000	3	$5,894,000
[24]	Whidbey Telephone Company	$1,525,000	1,525,000	6	$5,496,000
[25]	Union Telephone Company	$811,000	811,000	2	$4,385,000
[26]	Manti Telephone Company	$949,800	949,800	5	$4,099,000
[27]	KTC AWS Limited Partnership	$466,100	466,100	3	$3,864,000
[28]	Bresnan Communications, Inc.	$3,500,000	3,500,000	3	$3,859,000
[29]	LL License Holdings, LLC	$925,000	925,000	5	$3,812,000
[30]	PVT Networks, Inc.	$1,257,000	1,257,000	4	$3,605,000
[31]	NSIGHTTEL WIRELESS, LLC	$1,000,000	1,000,000	2	$3,359,000
[32]	Bluegrass Wireless LLC	$1,100,000	1,100,000	5	$3,272,000
[33]	Blue Valley Tele-Communications, Inc.	$66,000	66,000	2	$3,079,000
[34]	SAL Spectrum, LLC	$10,000,000	10,000,000	5	$2,941,000
[35]	Cincinnati Bell Wireless LLC	$4,400,000	4,400,000	2	$2,829,000
[36]	PCS Partners, L.P.	$1,000,000	1,000,000	8	$2,821,000
[37]	Agri-Valley Communications, Inc.	$1,100,000	1,100,000	4	$2,508,000
[38]	Comporium Wireless, LLC	$1,017,000	1,017,000	2	$2,350,000
[39]	Chariton Valley Communication Corporation, Inc.	$58,000	58,000	1	$2,335,000
[40]	Sky Com 700 MHZ, LLC	$77,000	77,000	1	$2,227,000
[41]	Club 42 CM Limited Partnership	$4,441,250	4,441,250	5	$2,227,000
[42]	Cross Telephone Company, LLC	$2,502,000	2,502,000	1	$2,051,000
[43]	N.E. Colorado Wireless Technologies, Inc.	$1,000,000	1,000,000	3	$2,022,000
[44]	Star Telephone Membership Corporation	$106,000	106,000	1	$1,968,000
[45]	VentureTel 700, Inc.	$705,500	470,334	7	$1,940,000
[46]	Worldcall Inc.	$411,000	411,000	7	$1,918,000
[47]	Cable Montana LLC	$450,000	450,000	1	$1,770,000
[48]	Iowa Intelegra Consortium, LLC	$1,753,785	1,753,785	7	$1,696,000
[49]	CHEVRON USA INC.	$78,000	52,000	3	$1,663,000
[50]	Pine Cellular Phones, Inc.	$291,900	291,900	2	$1,646,000
[51]	Vermont Telephone Company, Inc.	$1,002,000	1,002,000	1	$1,597,000

AUCTION 73: BIDDERS AND PWB WINNERS, Cont.

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
[52]	Sandhill Communications, LLC	$80,000	80,000	1	$1,590,000
[53]	Glenwood Telephone Membership, Corporation	$607,000	607,000	2	$1,527,000
[54]	Midwest AWS Limited Partnership	$368,000	368,000	1	$1,519,000
[55]	The World Company	$690,000	690,000	1	$1,495,000
[56]	Kurian, Thomas K	$1,000,000	1,000,000	3	$1,479,000
[57]	MTN3B Consortium	$571,700	571,700	5	$1,409,000
[58]	PTI Pacifica, Inc.	$103,300	103,300	1	$1,293,000
[59]	Broadband Wireless Unlimited, LLC	$400,000	400,000	9	$1,239,000
[60]	Ligtel Communications, Inc.	$215,000	215,000	1	$1,219,000
[61]	Buggs Island Telephone Cooperative	$319,000	319,000	3	$1,132,000
[62]	Small Ventures USA, L.P.	$700,000	700,000	1	$1,055,000
[63]	Public Service Wireless Services, Inc.	$987,000	987,000	2	$1,039,000
[64]	The Chillicothe Telephone Company	$216,000	216,000	1	$1,038,000
[65]	Choice Phone LLC	$116,300	116,300	2	$1,003,000
[66]	Bascom Long Distance, Inc.	$93,000	93,000	1	$925,000
[67]	AWS Spectrum, LLC	$600,000	600,000	1	$887,000
[68]	Toba Inlet PCS, LLC	$2,000,000	2,000,000	2	$871,000
[69]	Columbia Cellular, Inc.	$40,000	40,000	1	$793,000
[70]	Gold Radio Group, LLC	$300,000	300,000	1	$710,000
[71]	Great American Broadband, Inc.	$450,000	450,000	4	$699,000
[72]	AlasConnect, Inc.	$202,000	202,000	1	$560,000
[73]	Dragon Arch, Inc.	$50,000	50,000	3	$538,000
[74]	Panhandle Telecommunication Systems, Inc.	$42,000	42,000	1	$435,000
[75]	Data-Max Wireless LLC	$56,000	56,000	1	$434,000
[76]	BPS Telephone Company	$929,000	929,000	1	$421,000
[77]	Piedmont Rural Telephone Cooperative, Inc.	$91,000	91,000	1	$418,000
[78]	West Carolina Communications, LLC	$99,000	99,000	1	$406,000
[79]	East Kentucky Network, LLC	$775,000	775,000	2	$406,000
[80]	Miles Communications Corp	$53,000	53,000	1	$392,000
[81]	USA Choice Internet Services Company LLC	$143,000	143,000	1	$387,000
[82]	BEK Communications Cooperative	$74,000	74,000	1	$383,000
[83]	Buffalo-Lake Erie Wireless Systems Co., L.L.C.	$535,000	535,000	2	$375,000
[84]	PBP Bidco LLC	$60,000	60,000	1	$326,000
[85]	James Valley Cooperative Telephone Company	$14,900	14,900	1	$306,000
[86]	Hemingford Cooperative Telephone Company	$249,000	249,000	1	$282,000
[87]	Red River Rural Telephone Association, Inc.	$32,000	32,000	1	$267,000
[88]	Chester Telephone Company	$50,000	50,000	1	$254,000
[89]	Pioneer Telephone Cooperative, Inc.	$460,000	460,000	1	$252,000
[90]	MTA Communications, Inc.	$816,000	816,000	2	$239,000
[91]	Spectrum Acquisitions, Inc.	$10,000	10,000	1	$238,000
[92]	Churchill County Telephone d/b/a CC Communications	$40,600	40,600	1	$210,000
[93]	maxima international llc	$135,000	135,000	2	$208,000
[94]	The S&T Telephone Cooperative Association, Inc.	$16,700	16,700	2	$192,000
[95]	WUE, Inc.	$4,800	4,800	1	$189,000
[96]	Paul Bunyan Rural Telephone Cooperative, Inc.	$400,000	400,000	1	$175,000
[97]	GreenFly LLC	$100,000	100,000	1	$159,000
[98]	C&W Enterprises, Inc.	$98,000	98,000	2	$129,000
[99]	Rural Telephone Service Company, Inc.	$11,000	11,000	1	$107,000
[100]	Reiter, Scott D	$57,000	57,000	1	$55,000
[101]	AST Telecom, LLC	$30,200	30,200	1	$20,000
	Subtotal	$2,284,823,335	1,783,890,603	1,090	$19,592,420,000

AUCTION 73: BIDDERS AND PWB WINNERS, Cont.

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
	Bidders that did not Win a License				
[102]	Google Airwaves Inc.	$287,371,000	287,371,000	0	$0
[103]	Alltel Corporation	$150,000,000	150,000,000	0	$0
[104]	Bluewater Wireless, L.P.	$90,825,000	90,825,000	0	$0
[105]	Cricket Licensee 2007, LLC	$70,000,000	70,000,000	0	$0
[106]	CSC Spectrum Holdings LLC	$22,475,000	22,475,000	0	$0
[107]	Lynch Wireless Broadband Company, LLC	$15,000,000	15,000,000	0	$0
[108]	Advance/Newhouse Partnership	$11,250,000	11,250,000	0	$0
[109]	Towerstream Corporation	$5,000,000	5,000,000	0	$0
[110]	Command Connect, LLC	$1,775,000	1,775,000	0	$0
[111]	Bayou Internet, Inc.	$1,116,000	1,116,000	0	$0
[112]	Xanadoo 700 MHz DE, LLC	$1,000,000	1,000,000	0	$0
[113]	Bay Electronics, Inc.	$930,000	930,000	0	$0
[114]	Forum Communications Company	$821,000	821,000	0	$0
[115]	The Ponderosa Telephone Co.	$791,000	791,000	0	$0
[116]	Neptuno Media	$704,400	704,400	0	$0
[117]	Lexcom, Inc.	$652,000	652,000	0	$0
[118]	Fidelity Communications Company	$616,000	616,000	0	$0
[119]	Socket Telecom LLC	$586,000	586,000	0	$0
[120]	Copper Valley Wireless, Inc.	$528,000	528,000	0	$0
[121]	ComSouth Tellular, Inc.	$500,000	500,000	0	$0
[122]	Lackawaxen Long Distance Company, Inc.	$500,000	500,000	0	$0
[123]	Valley Telephone Cooperative, Inc.	$484,000	484,000	0	$0
[124]	Budget Phone	$456,000	456,000	0	$0
[125]	Palmetto Rural Telephone Cooperative, Inc.	$415,000	415,000	0	$0
[126]	East Ascension Telephone Company, LLC	$411,000	411,000	0	$0
[127]	Aristotle Inc.	$350,000	350,000	0	$0
[128]	TCT West, Inc.	$348,000	348,000	0	$0
[129]	Delmarva Broadband LLC	$339,000	339,000	0	$0
[130]	Inland Cellular Telephone Company	$339,000	315,000	0	$0
[131]	RONAN TELEPHONE COMPANY	$309,000	309,000	0	$0
[132]	CRT Holdings, Inc.	$306,000	306,000	0	$0
[133]	Kaplan Telephone Company, Inc.	$287,000	287,000	0	$0
[134]	Nunn Communications, LLC	$260,000	260,000	0	$0
[135]	Central Wisconsin Communications, Inc.	$233,000	233,000	0	$0
[136]	Granite State Long Distance, Inc.	$229,000	229,000	0	$0
[137]	Northeast Nebraska Telephone Company	$215,000	215,000	0	$0
[138]	Northern New Mexico Telecom, Inc.	$210,800	210,800	0	$0
[139]	Ellijay Telephone Company	$195,000	195,000	0	$0
[140]	Sierra Cellular, Inc.	$192,000	192,000	0	$0
[141]	Chequamegon Communications Cooperative, Inc.	$177,000	177,000	0	$0
[142]	COLI INc	$175,000	175,000	0	$0
[143]	Eastern Colorado Wireless II, LLC	$164,000	164,000	0	$0
[144]	Polar Communications Mutual Aid Corporation	$164,000	164,000	0	$0
[145]	Day Management Corporation	$163,000	163,000	0	$0
[146]	ACS Wireless License Sub, Inc.	$156,000	156,000	0	$0
[147]	Mulberry Cooperative Telephone Company, Inc	$156,000	156,000	0	$0
[148]	Adams Telcom, Inc.	$149,000	149,000	0	$0
[149]	FTC Management Group, Inc.	$145,000	145,000	0	$0
[150]	Cumby Telephone Cooperative, Inc.	$141,000	141,000	0	$0
[151]	CTC Telcom, Inc.	$131,000	131,000	0	$0
[152]	Mediapolis Telephone Company	$127,000	127,000	0	$0
[153]	Grand River Communication, Inc.	$123,000	123,000	0	$0
[154]	Surry Telecommunications, Inc.	$123,000	123,000	0	$0
[155]	Danville Mutual Telephone Company	$117,000	117,000	0	$0
[156]	Poka Lambro Telecommunications, LTD	$113,000	113,000	0	$0
[157]	Pulse Mobile LLC	$108,000	108,000	0	$0

AUCTION 73: BIDDERS AND PWB WINNERS, Cont.

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
[158]	WWW Broadband, LLC	$108,000	108,000	0	$0
[159]	IdeaOne Telecom Group, LLC	$105,000	105,000	0	$0
[160]	Mid-Missouri Telephone Company	$100,000	100,000	0	$0
[161]	Washington County Rural Telephone Cooperative, Inc	$95,000	95,000	0	$0
[162]	MAC Wireless, LLC	$92,000	92,000	0	$0
[163]	Blaze Broadband LLC	$89,000	89,000	0	$0
[164]	MH Telecom, LLC	$87,000	87,000	0	$0
[165]	LCDW Wireless Limited Partnership	$86,000	86,000	0	$0
[166]	West Wisconsin Telcom Cooperative, Inc.	$78,000	78,000	0	$0
[167]	Siskiyou Telephone Company	$76,000	76,000	0	$0
[168]	Kingdom Telephone Company	$75,000	75,000	0	$0
[169]	Western Iowa Telephone Association	$74,000	74,000	0	$0
[170]	The Tri-County Telephone Association, Inc.	$69,000	69,000	0	$0
[171]	Huxley Communications Corp.	$68,000	68,000	0	$0
[172]	Northern Iowa Communications Partners, LLC	$68,000	68,000	0	$0
[173]	Independents Fiber Network, LLC	$65,000	65,000	0	$0
[174]	New Ulm Telecom, Inc.	$63,000	63,000	0	$0
[175]	United Wireless Communications Inc.	$61,000	61,000	0	$0
[176]	North Dakota Network Company	$58,000	58,000	0	$0
[177]	Guam Cellular & Paging	$54,300	54,300	0	$0
[178]	Three River Telco	$53,000	53,000	0	$0
[179]	SeaBytes, L.L.C.	$52,000	52,000	0	$0
[180]	Farmers Telecommunications Cooperative, Inc.	$51,000	51,000	0	$0
[181]	The Pioneer Telephone Association, Inc.	$50,700	50,700	0	$0
[182]	Glass, Laurence B	$49,000	49,000	0	$0
[183]	Tri-Valley Communications, LLC	$43,000	43,000	0	$0
[184]	Rainbow Telecommunications Association, Inc.	$42,000	42,000	0	$0
[185]	CSConnect Inc.	$41,000	41,000	0	$0
[186]	McDonald County Telephone Company	$40,000	40,000	0	$0
[187]	FWC Communications, Inc.	$38,000	38,000	0	$0
[188]	Kinex Networking Solutions, Inc.	$34,000	34,000	0	$0
[189]	Citizens Mutual Telephone Cooperative	$33,000	33,000	0	$0
[190]	Muenster Telephone Corporation of Texas	$33,000	33,000	0	$0
[191]	Northeast Missouri Rural Telephone Company	$33,000	33,000	0	$0
[192]	Van Buren Wireless, Inc.	$33,000	33,000	0	$0
[193]	Blanca Telephone Company	$30,000	30,000	0	$0
[194]	Farmers Telephone Company, Inc.	$29,000	29,000	0	$0
[195]	H & B Communications, Inc.	$29,000	29,000	0	$0
[196]	NatTel, LLC	$40,000	26,667	0	$0
[197]	Green Hills Area Cellular Telephone, Inc.	$26,000	26,000	0	$0
[198]	Computer Techniques, Inc.	$25,000	25,000	0	$0
[199]	FMTC Wireless, Inc.	$24,000	24,000	0	$0
[200]	Corn Belt Telephone Company, Inc.	$22,000	22,000	0	$0
[201]	Muskrat Wireless, LP	$22,000	22,000	0	$0
[202]	Slopeside Internet	$21,000	21,000	0	$0
[203]	Missouri Valley Wireless, LLC	$20,000	20,000	0	$0
[204]	USA Broadband LLC	$20,000	20,000	0	$0
[205]	Vavasi NexGen Inc.	$20,000	20,000	0	$0
[206]	Northwest Missouri Cellular Limited Partnership	$15,000	15,000	0	$0
[207]	BlueBird Telecommunications Ltd.	$13,000	13,000	0	$0
[208]	Golden Belt Telephone Association, Inc.	$10,000	10,000	0	$0
[209]	Xpressweb Internet Services, Inc.	$10,000	10,000	0	$0
[210]	Cascade Access, L.L.C.	$4,800	4,800	0	$0
[211]	Robinson, Jack E	$2,700	1,800	0	$0
[212]	world network international services Inc.	$1,000	1,000	0	$0
[213]	First Mile Holdings, Inc.	$500	500	0	$0
	Subtotal	$673,033,200	672,994,967	0	$0

Source: http://wireless.fcc.gov/auctions/default.htm?job=auction_factsheet&id=73.

APPENDIX A-3
AUCTION 97: BIDDERS AND PWB WINNERS

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
	PWB Winners				
[1]	AT&T Wireless Services 3 LLC	$920,752,900	920,752,900	251	$18,189,285,000
[2]	Cellco Partnership d/b/a Verizon Wireless	$920,752,900	920,752,900	181	$10,430,017,000
[3]	Northstar Wireless, LLC	$508,000,000	508,000,000	345	$7,845,059,400
[4]	SNR Wireless LicenseCo, LLC	$412,000,000	412,000,000	357	$5,482,364,300
[5]	T-Mobile License LLC	$417,000,000	417,000,000	151	$1,774,023,000
[6]	Advantage Spectrum, L.P.	$60,000,000	60,000,000	124	$451,072,000
[7]	2014 AWS Spectrum Bidco Corporation	$57,692,050	57,692,050	18	$389,080,000
[8]	Puerto Rico Telephone Company, Inc.	$7,882,500	5,255,000	15	$170,901,300
[9]	Tristar License Group, LLC	$55,000,000	55,000,000	12	$62,808,000
[10]	NE Colorado Cellular, Inc.	$1,408,900	1,408,900	19	$30,718,000
[11]	Sofio, Joseph A	$2,590,000	2,590,000	28	$17,978,000
[12]	Cypress Cellular, LP	$6,736,000	6,736,000	40	$13,579,000
[13]	Orion Wireless LLC	$6,000,000	6,000,000	16	$10,410,000
[14]	Smith Bagley, Inc.	$1,764,000	1,764,000	11	$10,293,000
[15]	Central Texas Telephone Investments, LP	$456,800	456,800	3	$3,321,000
[16]	KURIAN, BEAULAH T	$450,000	450,000	7	$2,906,000
[17]	FTC Management Group, Inc.	$58,000	58,000	2	$2,696,000
[18]	Geneseo Communications Services, Inc.	$779,000	779,000	2	$2,332,000
[19]	Nsight Spectrum, LLC	$816,000	816,000	1	$1,499,000
[20]	Docomo Pacific, Inc.	$395,700	395,700	1	$1,386,000
[21]	Emery Telcom-Wireless, Inc.	$675,000	675,000	4	$1,237,000
[22]	Sandhill Communications, LLC	$45,000	45,000	1	$1,063,000
[23]	Pioneer Telephone Cooperative, Inc.	$282,000	282,000	3	$991,000
[24]	Ligtel Communications, Inc.	$40,000	36,000	1	$861,000
[25]	Michigan Wireless, LLC	$1,000,000	1,000,000	7	$829,000
[26]	Gila River Telecommunications, Inc.	$602,500	602,500	1	$818,000
[27]	Northern Valley Communications, LLC	$97,500	97,500	1	$694,000
[28]	Chester Telephone Company	$20,000	20,000	1	$483,000
[29]	Spotlight Media Corp., Inc.	$1,000,000	1,000,000	1	$371,000
[30]	Triangle Communication System, Inc.	$30,900	30,900	6	$221,600
[31]	RigNet Satcom, Inc.	$65,000	65,000	1	$155,000
	Subtotal	$3,384,392,650	$3,381,761,150	1,611	$44,899,451,600

AUCTION 97: BIDDERS AND PWB WINNERS, Cont.

	Bidders [A]	Upfront Payment [B]	Initial Eligibility [C]	Licenses Won [D]	Total PWB [E]
	Bidders that did not Win a License				
[32]	American AWS-3 Wireless I L.L.C.	$400,000,000	400,000,000	0	$0
[33]	SAAS License, LLC	$175,000,000	175,000,000	0	$0
[34]	Bluewater Wireless, L.P.	$99,500,000	99,500,000	0	$0
[35]	Triad 8, LLC	$34,000,000	34,000,000	0	$0
[36]	BC4 LLC	$33,000,000	33,000,000	0	$0
[37]	Lynch 3G Communications Corporation	$19,000,000	19,000,000	0	$0
[38]	Atlantic Seawinds Communications, LLC	$1,303,200	1,303,200	0	$0
[39]	The Ponderosa Telephone Co.	$1,258,500	1,258,500	0	$0
[40]	PVT Networks, Inc.	$1,040,000	1,040,000	0	$0
[41]	Palmetto Rural Telephone Cooperative, Inc.	$684,000	684,000	0	$0
[42]	VTel Wireless, Inc.	$592,000	592,000	0	$0
[43]	ReiTeR, ScoTT D	$425,000	425,000	0	$0
[44]	Teleguam Holdings, LLC	$353,000	353,000	0	$0
[45]	Horry Telephone Cooperative, Inc.	$297,000	297,000	0	$0
[46]	Cerberus Communications Limited Partnership	$257,000	257,000	0	$0
[47]	Texas RSA 7B3, L.P. dba Peoples Wireless Services	$231,000	231,000	0	$0
[48]	Pine Cellular Phones, Inc.	$227,500	227,500	0	$0
[49]	Bluegrass Wireless LLC	$182,000	182,000	0	$0
[50]	Glenwood Telephone Membership Corporation	$170,000	170,000	0	$0
[51]	Paul Bunyan Rural Telephone Cooperative	$155,900	155,900	0	$0
[52]	FMTC Wireless, Inc.	$153,000	153,000	0	$0
[53]	Rainbow Telecommunications Association, Inc.	$151,000	151,000	0	$0
[54]	C&W Enterprises, Inc.	$97,400	97,400	0	$0
[55]	Smithville Spectrum, LLC	$97,000	97,000	0	$0
[56]	Big River Broadband, LLC	$80,000	80,000	0	$0
[57]	Grand River Communications, Inc.	$80,000	80,000	0	$0
[58]	Hemingford Cooperative Telephone Company	$76,500	76,500	0	$0
[59]	Webster-Calhoun Cooperative Telephone Association	$60,000	60,000	0	$0
[60]	RSA 1 Limited Partnership d/b/a Chat Mobility	$50,000	50,000	0	$0
[61]	SI Wireless, LLC	$46,500	46,500	0	$0
[62]	Piedmont Rural Telephone Cooperative, Incorporated	$27,000	27,000	0	$0
[63]	Wolverine Wireless, LP	$27,000	27,000	0	$0
[64]	Home Enterprises, Inc.	$25,000	25,000	0	$0
[65]	Southeastern Indiana Rural Telephone Coop., Inc.	$17,000	17,000	0	$0
[66]	Bek Communications Cooperative	$11,500	11,500	0	$0
[67]	Zephyr Spectrum Holdings	$5,000	5,000	0	$0
[68]	S&T Communications, Inc.	$3,900	3,900	0	$0
[69]	City of Ketchikan d.b.a. KPU Telecommunications	$3,600	3,600	0	$0
[70]	Sagebrush Cellular, Inc.	$1,600	1,600	0	$0
	Subtotal	$768,689,100	768,689,100	0	$0

Source: http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=97.

CAMBRIDGE
NEW YORK
SAN FRANCISCO
WASHINGTON
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THE Brattle GROUP